The North Korean Missile Threat

Historical Context

The North Korean threat against the United States stems from the country's history with the U.S., its self-perception, and how it interprets U.S. actions in the international arena. Korea's direct interaction with the United States began near the end of World War II. During the war, Korea had been annexed and brutally oppressed by Japan. As Japan began to lose the war in both China and the Pacific, the Japanese brought Koreans to Japan and interned them in labor camps. As a result, many of those who would later become North Korean leaders witnessed, allegedly firsthand for some, the U.S. nuclear bombings on Hiroshima and Nagasaki.

The experiences of Japanese oppression and the destructive power of atomic weapons left a deep impression on the North Korean psyche. The concept that the Korean peninsula was vulnerable to foreign occupation, as well as observing the strategic effects of two nuclear bombs, left much of the North Korean population with a deep seated desire to have the ability to defend the peninsula from further aggression.

The apprehension from perceived outside threats was amplified with the Korean war (1950-53). During the war, widespread rumors emerged of the U.S. using biological and chemical weapons against the Chinese and North Korean people, along with accusations of the U.S. torturing and murdering civilians established a strong hatred and fear of the United States among North Koreans. This hatred was exacerbated by other events, such as U.S. President Harry Truman's multiple threats throughout the war to use nuclear weapons on the North Korean military.

The Korean war ended with a ceasefire and a strong U.S. military presence in South Korea, especially along the border of North Korea. Also, because of the U.S. led international intervention into what the North Korean people felt was a domestic issue, the relatively new Democratic People's Republic of Korea (DPRK) believed the U.S. was responsible for a non-unified Korean people and country. To the North Koreans, U.S. involvement in the Korean war was the U.S. meddling in Korean affairs.

In addition, U.S. involvement in conflicts such as Vietnam, Grenada, Panama, Iraq, Libya and Somalia – conflicts the DPRK viewed as internal issues – demonstrated to the DPRK the United States' interference in the internal affairs of sovereign states. These conflicts, along with previous interactions directly with the U.S., resulted in the North Korean regime viewing the U.S. as a significant threat.

Along with these events is the evolving North Korean cultural concept of "Juche" (self-reliance). The Juche ideology derives from Korean history as well as Soviet influence. In the ideology, man has power over everything, not a higher being. Since man holds the power in the North Korean philosophy, as well as Korea's confuscion heritage where authority lies in the elder male, leaders such as Kim Il-sung (the founder of the the DPRK) and the current leader, Kim Jung-un, are looked at in near godlike terms, which is further inspired by regime propaganda. Moreover, in the Juche ideology, the collective is more important than the individual. The state matters more than personal comfort or satisfaction. Since the regime is the sole authority and represents the collective in North Korea, the Juche ideology promotes the concept that the regime comes first. The regime must be placed first and obeyed in order for the state to keep itself from becoming dependent on outside forces. This core concept embedded in the North Korean psyche may also create difficulty for other countries – primarily China – to control or limit the North Korean regime from its ambitions.

Juche is responsible for many North Korean policies, including the songun (military first) policy, which mandates one-third of North Korea's budget to the military and authorizes conscription of all North Koreans (women began being drafted in 2014 for seven year terms). Policies such as songun, demonstrate the North Korean drive for self reliance and independence in the international arena. Also, as previously stated, North Korea has witnessed the "meddling" of local and regional issues by dominant powers.

North Korean propaganda poster saying "The entire American mainland is within our range."

But, dominant powers are noticeably hesitant in interfering in local affairs where the local regime possesses nuclear weapons. Therefore, this combined with the fundamental Juche philosophy has left the regime with an ardent desire to have a strong nuclear arsenal. To the North Korean regime, a strong nuclear arsenal and the capability to hit the United States with nuclear weapons gives the North Korean regime the ultimate means to defend itself against the "threatening" United States.

Furthermore, there is the inherent fear among North Korean "elites", that if the regime were to fall, then the "elites" of the regime would lose power or be tried for crimes against humanity. This has led many of the elites to conclude that the survival of the regime is directly tied to their own survival. Therefore, having means to keep the regime in power is of utmost importance to North Korea's decision makers. Moreover, the denuclearization of other states and what happened to that state's regime after has further hardened the regime's fear of losing power and has tied the DPRK's survival directly to its nuclear capability. One example demonstrating this fear was the collapse of Colonel Muammar Qaddaffi's regime and his death in 2011 after Qaddaffi surrendered Libya's nuclear program in 2003. To the North Korean regime, Qadaffi's decision to surrender Libya's nuclear program directly resulted in the collapse of the regime and his death, as well as enabled other international actors the opportunity to intervene and "invade" Libya with such ease during the 2011 civil war.

These factors, along with other domestic politics, have been the driving factors for the North Korean regime's nuclear and ballistic missile proliferation as well as its interaction with the U.S. over the decades. The DPRK has consistently broken treaties and relations regarding the denuclearization or cancelling of its ballistic missile program, and instead continues to proliferate despite international pressure, sanctions, and contempt. This behavior indicates that the regime will not stop in its proliferation of nuclear weapons and ballistic missiles through diplomatic channels alone. In order to counter this growing threat, the U.S. will need a strong missile defense.

North Korea's Nuclear Program

For over a decade, North Korea has demonstrated that it possesses both nuclear and ballistic missile capabilities. These demonstrations have included numerous nuclear and ballistic missile tests which have antagonized neighbors and further alienated the reclusive nation from the rest of the world.

North Korea has demonstrated an ability to fuel nuclear devices with both weapons grade plutonium and uranium. Fissile material for Pyongyang's nuclear program comes primarily from Yongbyon, where the nation has an experimental nuclear reactor that produces reactor-grade plutonium and centrifuges that create enriched uranium. To produce weapons-grade plutonium-239, North Korea reprocesses spent plutonium from the reactor at Yongbyon. In September 2015, Yongbyon's reactor resumed normal operation after years of inactivity, bolstering the DPRK's supply of reactor-grade plutonium. Despite a reinvigorated supply of plutonium, it is likely that the future of Pyongyang's nuclear program will center on highly enriched uranium because of North Korea's large uranium ore reserves and its ability to produce highly enriched uranium-235. To produce highly enriched uranium, Pyongyang uses centrifuges located at Yongbyon; however, some experts suspect that the DPRK has other centrifuges at clandestine nuclear facilities unknown to outsiders.

The Kim regime conducted underground nuclear tests in 2006, 2009, 2013, 2016 and 2017. The 2006 nuclear test involved a device fueled by plutonium and the yield was measured to be less than one kiloton indicating that the test was not a success. In 2009, the regime conducted another underground test with reprocessed plutonium and a yield around four kilotons. The 2013 underground nuclear test likely used highly enriched uranium rather than plutonium and resulted in a higher yield than the previous tests. The DPRK claimed that the device was a miniaturized nuclear warhead, small enough to fit onto a missile. In January 2016, North Korea carried out its fourth underground nuclear test, which the state-controlled media claimed to be a hydrogen bomb. Although the yield for the January 2016 test was higher, around 10 to 15 kilotons, many experts argue that it was not in fact a thermonuclear detonation. In September 2016, North Korea conducted its fifth underground nuclear test with a yield of 10-20 kt, although the state media did not claim this one as a hydrogen bomb. Finally, North Korea's most recent and 6th nuclear test was on September 3rd, 2017. North Korea claimed the test was of a thermonuclear warhead, capable of being used on its Hwasong-14 and Hwasong-12 ballistic missiles.

This map shows seismic activity caused by North Korean nuclear tests. Source: BBC

Kim Jong-un is shown a model of North Korea's thermonuclear warhead to be used in its Hwasong-14 ICBM.

Current estimates of the test place the yield from 50 to 100 kilotons. Experts are still determining whether North Korea's claim is true, but regardless of whether the test was of a thermonuclear or boosted nuclear warhead, the yield was a significant increase from North Korea's previous tests and indicates a substantial development for North Korea's arsenal.

The United States and its allies have made efforts to address North Korea's proliferation activities through both diplomacy and sanctions. Diplomatic efforts began in the early 1990s after the United States announced its intention to withdraw tactical nuclear weapons deployed around the world, including those in South Korea. Following this initiative, both North and South Korea signed the Joint Declaration of South and North Korea on the Denuclearization of the Korean Peninsula to eliminate nuclear weapons completely from the Peninsula. In early 1992, North Korea signed a safeguard agreement with the International Atomic Energy Agency (IAEA) which called for an initial declaration of its nuclear facilities and allowed the IAEA to independently inspect the sites. However, in late 1992, the IAEA discovered inconsistencies with the initial report and requested special inspections to investigate the discrepancies. North Korea refused to allow inspections of the suspect facilities and in March of 1993 gave notice to the United Nations Security Council of its intentions to withdraw from the Nuclear Nonproliferation Treaty (NPT). By mid-1993 the DPRK reversed this decision just before its withdrawal would be complete and began negotiations to allow the IAEA to resume its work.

In 1994, the United States and North Korea entered into an agreement known as the Agreed Framework, which called for the U.S. to supply the DPRK with a light water reactor facility to generate energy in exchange for "freezing" its nuclear program. However, by 2003, more complications between North Korea and the IAEA prompted Pyongyang to order inspectors out of the country and withdraw from the NPT. Further efforts to address North Korea's nuclear program were made in the form of multi-lateral discussions between China, the United States, North and South Korea, Japan, and Russia, coined the Six Party Talks. Although, after several rounds of discussions, talks broke down yielding no results.

Efforts to address North Korea's ballistic missile program have been similarly frustrated by Pyongyang's unwillingness to cooperate with the international community. North Korea has refused to participate in the Missile Technology Control Regime, a voluntary arrangement among member nations who are committed to controlling the spread of missile technology. North Korea is a willful proliferator of ballistic missile technology and has provided full systems, components, technology, and expertise to countries in the Middle East, South Asia, and North Africa. The United Nations Security Council has adopted several resolutions in response to North Korea's nuclear and ballistic missile programs. The most recent resolutions have been UN resolution 2321, 2371, and 2375. Resolution 2321 was adopted November 30, 2016, and condemned the DPRK for pursuing nuclear weapons instead of the welfare of the people as well as imposed sanctions on North Korea's exportation of minerals such as copper, nickel, silver, and zinc. Resolution 2371 was adopted August 5, 2017, and imposed sanctions on North Korea's exportation of coal, iron, and iron ore, and reaffirmed the UN's support for the Six Party Talks. The most recent resolution is 2375, which was voted and adopted on September 11, 2017. This resolution bans, "the supply, sale or transfer of all condensates and natural gas liquids to the DPRK... beyond a 500,000 barrels during an initial period of three months." Moreover, the resolutions ban the export of North Korean textiles and new work visas for North Koreans in foreign countries.

An image released during a North Korean concert to commemorate the September 2017 nuclear test, displaying preparations for the thermonuclear warhead.

In addition to its provocative proliferation of nuclear weapons and ballistic missiles, Pyongyang regularly issues threats against the United States and its neighbors in the region. Since the 1990s, North Korea has consistently threatened South Korea, the United States, and U.S. forces in the Pacific with nuclear attack. Until recently, most of Pyongyang's threats were indirect and did not overtly mention the use of nuclear weapons. In 1994, a negotiator from the DPRK threatened to turn South Korea into a "sea of fire," a phrase that has been repeated several times since.

In 2002, Pyongyang claimed it would "mercilessly wipe out the aggressors" after U.S. President George W. Bush declared that North Korea was part of the "axis of evil." In 2012, the DPRK threatened a "merciless and sacred war" with South Korea. However, things changed in 2015, when Pyongyang issued a direct nuclear threat when a director of the North Korean Atomic Energy Institute claimed, "If the U.S. and other hostile forces persistently seek their reckless hostile policy towards the DPRK and behave mischievously, the DPRK is ready to cope with them with nuclear weapons any time."

Kim Jong-un observes February 2016 missile launch.

Provocation by the North Korean regime has continued with its threat to launch four IRBMs to land within 30-40km of Guam in August 2017. Although the regime has yet to make true on its word, tension with the regime has risen significantly in recent months. As well, the North Korean regime has made multiple threatening statements aimed at the U.S., Japan, and South Korea reiterating its determination to develop nuclear capable ballistic missiles.

To weaponize its nuclear capability, the DPRK would need to miniaturize a device small enough to fit on a delivery system, such as a ballistic missile or gravity bomb. Currently, North Korea's only nuclear delivery systems are ground-based ballistic missiles. However, the nation is currently developing submarine-launched ballistic missiles and cruise missiles capable of delivering nuclear payloads as well. While concrete evidence indicating the DPRK has miniaturized nuclear warheads remains elusive, many experts believe that the isolationist nation has the capability to create nuclear warheads that can fit atop its ballistic missiles. Currently, experts estimate North Korea has a nuclear stockpile of 10-30 nuclear weapons, based on both plutonium and uranium production. As North Korea continues to advance its nuclear weapons program, the number of weapons they can produce will increase and some experts claim that the DPRK could maintain a stockpile of 100 nuclear warheads by 2020.

In addition to its nuclear program, North Korea is also suspected of possessing both chemical and biological weapon capabilities.North Korea began its own chemical weapons development in 1954. By 2014, it was believed that North Korea had between 2,500 to 5,000 metric tons of chemical weapons. North Korea's chemical weapons capability received widespread attention and scrutiny recently, when the regime used VX nerve gas to assassinate Kim Jung-un's half-brother, Kim Jong-nam. In addition to VX, it is believed that North Korea also possesses Sarin gas, another nerve agent, along with dual use chemicals such as phosphate, ammonium, fluoride, chloride, and sulfur. According to South Korea's Institute of Chemical Technology, North Korea has 11 facilities where chemical weapons are developed and stored, along with 13 research and development facilities. However, given the state of North Korea's economy and access to resources needed to maintain chemical weapons, it is unknown how usable the stockpiled chemical weapons are.

As well, it is believed among North Korean experts that North Korea does possess biological weapons, mainly anthrax, smallpox, and cholera. However, whether North Korea is capable of developing its biological weapons is still up to speculation. Biological weapons are significantly more difficult to develop than chemical weapons, requiring much more extensive knowledge, skill, and resources to create such weapons and store effectively. Moreover, it is also difficult to determine if North Korea can develop and produce its own biological weapons, given that biological development facilities can easily be disguised as research centers for vaccines or hidden inside universities.

NORTH KOREA'S BALLISTIC MISSILE ARSENAL

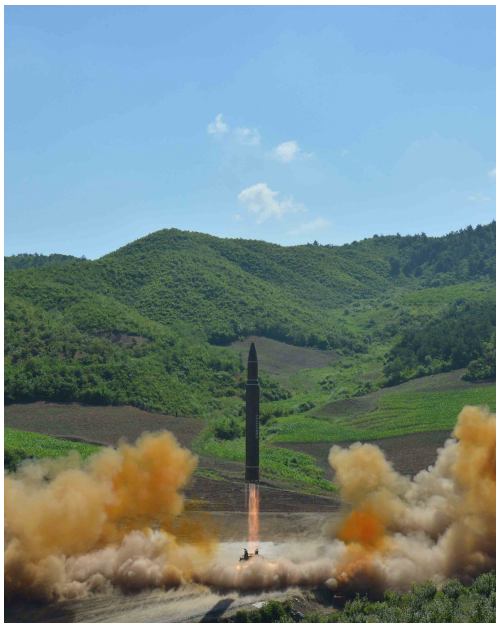
North Korea's efforts to develop ballistic missile capabilities date back to the Cold War, when the Soviet Union and China likely provided the isolationist nation with technical assistance. The DPRK's ballistic missile capabilities have progressed significantly over the last few decades, evolving from artillery rockets in the 1960s, to short- and medium-range ballistic missiles in the 1980s and 90s, and finally developing and testing intermediate-range and intercontinental ballistic missiles (ICBMs), beginning in the late 1990s and continuing today. In 1965, North Korean leader Kim Il-sung chose to develop ballistic missile capabilities by increasing the military budget and relying on outside assistance from the Soviet Union and China. As a result, the isolationist state made rapid progress in its ballistic missile program by the increased military funding as well as reverse engineering the missiles of its Communist allies. In 1998, after an attempted satellite launch with a multi-stage missile, North Korea demonstrated a willingness to develop ICBMs that could target the United States homeland. Since Kim Jong-un came to power, there has been a notable increase in missile tests and rapid technological developments, including the successful launch of an ICBM and some solid-fuel missiles. In 2017 alone, North Korea has conducted 24 missile tests, including successful tests of three new long-range missiles, two ICBMs labeled the Hwasong-14 and Hwasong-15, and an intermediate-range ballistic missile (IRBM) marked the Hwasong-12, that can reach Guam, Hawaii, Alaska, and the continental United States. North Korea continues to test and improve its ballistic missile capabilities and is an active proliferator of missile systems, components, and technology.

INTERCONTINENTAL-RANGE BALLISTIC MISSILES (ICBMS)

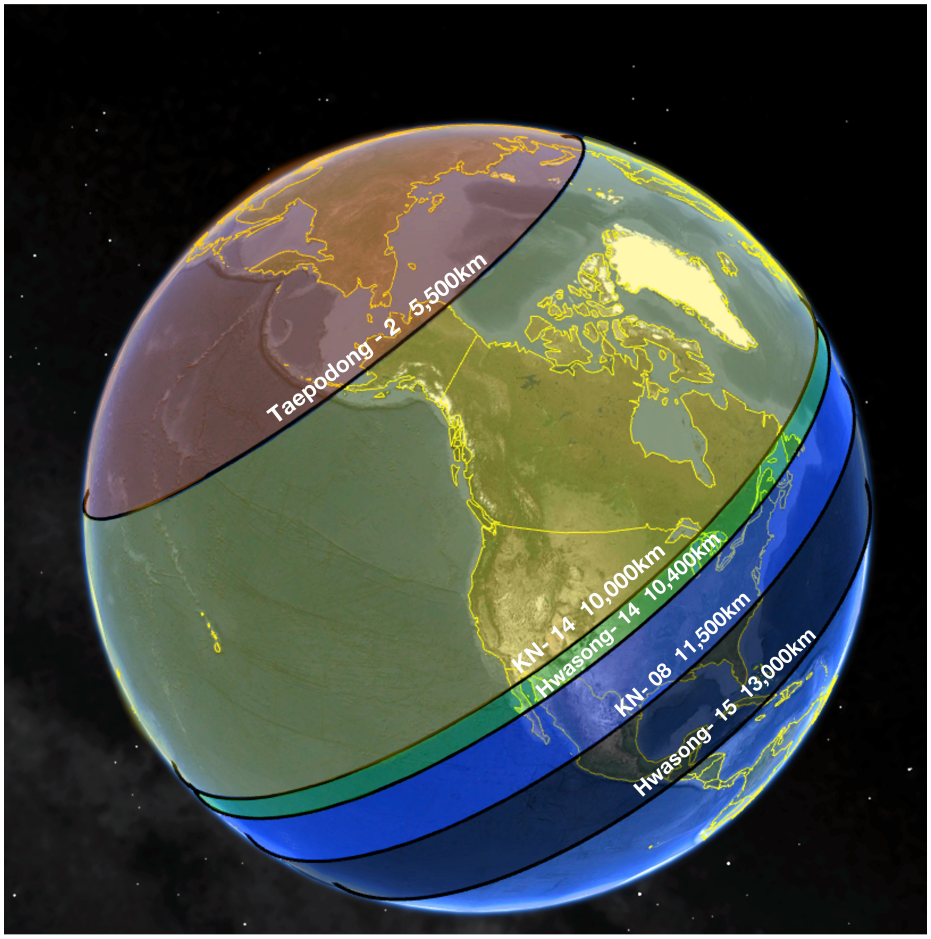
North Korea's known intercontinental-range ballistic missiles are the Taepodong series of missiles, the KN-08, the KN-14, the Hwasong-14, and the Hwasong-15. The Taepodong series includes both the Unha-2 and the Unha-3. The Unha-2 is a two-stage ballistic missile with an estimated range of 6,000 – 9,000 km and a payload capacity of 100 to 500 kg. The DPRK first tested the Unha-2 in 2006, but the missile failed to perform to standards. Nonetheless, the Unha-2 is considered operational and has the capability to strike Alaska and the U.S. West Coast.

North Korea has also developed and tested a three-stage version of the Taepodong-2, also called the Unha-3, which, according to Pyongyang, is a rocket designed to put a satellite into orbit. However, some experts speculate that the long-range rocket could be employed as a silo-based ICBM. If deployed as a ballistic missile, the Unha would have a potential range of 10,000 km and an estimated payload capacity between 100 and 1,000 kg, meaning the missile could be used to deliver a sizable nuclear payload to targets in the central United States. The Unha has been tested four times: April 2009, April 2012, December 2012, and February 2016. The rocket failed to put a satellite into orbit during the first two tests, but was successful during the last two. Despite the true intentions of the Kim regime for the Unha, the successful tests of the Unha rocket demonstrate a North Korean ability to develop a multi-stage ballistic missile capable of striking the U.S. homeland.

Purported mock-up of KN-08



July 4, 2017 2012 Hwasong-14 ICBM Launch



The ranges of North Korea's ICBMs.

In April 2012, during a parade to honor its founder, Kim Il-sung, the DPRK displayed a new ICBM known as the Hwasong-13 or the KN-08. The KN-08 is a road-mobile ICBM that has never been tested, but experts estimate it has the potential to strike the continental United States with a nuclear payload. Diagrams released in August 2017, depict the KN-08 as a three-stage rocket with a potential range of 12,000 km. The road-mobile capability of the KN-08 increases uncertainty about the missiles launch locations, which presents a significant challenge to U.S. and allied forces.

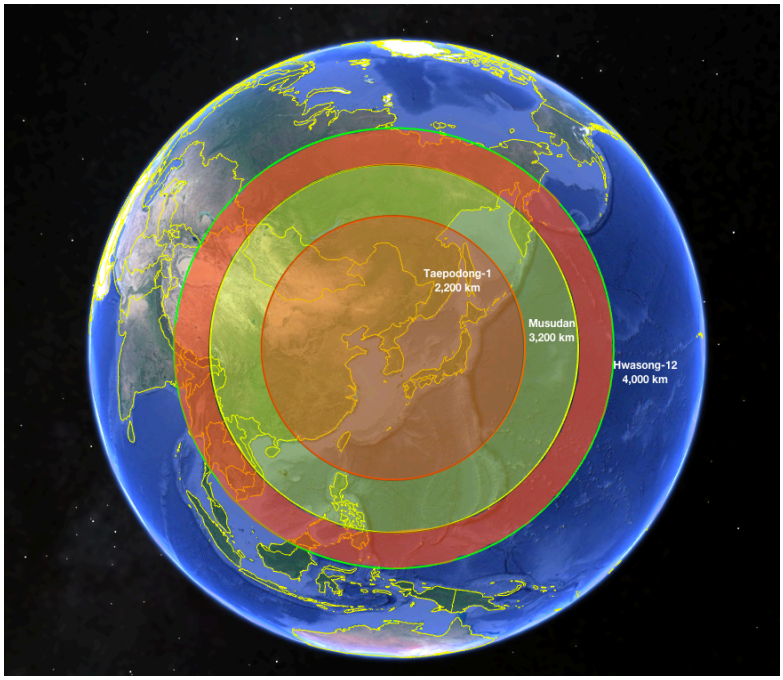
First unveiled on October 10, 2015, the KN-14 is considered by many experts to be a variant of North Korea's KN-08 ICBM prototype. However, the missile has never been tested. The KN-14 is speculated to have two stages – in contrast to the three-staged KN-08 – and therefore estimated to have shorter ranges of 8,000 - 10,000 km (2,000 – 4,000 km less than the speculated range of the KN-08). Like the KN-08, the KN-14 is road-mobile, increasing the uncertainty of possible launch locations attributed to the missile's deployment.

The Hwaong-14, also known as the KN-20, is a two-stage version of the Hwasong-12 IRBM. The Hwasong-14 was first seen on July 4, 2017, when it was successfully flight tested for the first time by North Korea. It flew for 39 minutes on a lofted trajectory before landing in the Sea of Japan. The Hwasong-14 was successfully tested again on July 28, 2017, where it flew again on a lofted trajectory for 47 minutes to a range of 1,000 km and an altitude of 3,700 km. Based on the July 28th test, experts estimate that the Hwasong-14 has a range over 10,000 km if flown on a range-maximizing ballistic trajectory.

The Hwasgong-15 has a wider and blunter nose cone than the Hwasong-14, indicating it could potentially carry a super-large heavy nuclear warhead, multiple warheads, or decoys. It is a two-stage missile, that most likely uses liquid fuel for both stages. The Hwasong-15 is the first indigenous North Korean missile that has a gimbaled engine system allowing for more efficient and accurate steering. Tested on November 29, 2017, the Hwasong-15 flew for approximately 54 minutes, reached an altitude of 4,500 km, and traveled around 960 km. If flown on a standard trajectory, the missile is estimated to have 13,000 km range. The test was a milestone, as it marked the longest flight of a North Korean ICBM and theoretically puts the whole continental United States in range.

Test launch of North Korea's Hwasong-15 ICBM on November 29, 2017.

INTERMEDIATE-RANGE BALLISTIC MISSILES (IRBMS)



The ranges of North Korea's IRBMs.

Pyongyang is believed to have three types of intermediate-range ballistic missiles (IRBMs): the Taepodong-1, the Musudan, and the Hwasong-12. The Taepodong-1 was North Korea's first multi-stage ballistic missile. The IRBM has an estimated range of 2,200 km and a payload capacity of 700 to 1,000 kg. Satellite photographs of the Taepodong-1 have caused experts to speculate that the intermediate-range missile has two stages: the first stage consists of components from the medium-range Nodong missile and the second stage is comprised of parts from the short-range Hwasong-5 missile. In 1998, a three stage mod of the Taepodong-1 was tested in an attempt to put a satellite into low earth orbit. During the test, the first two stages worked correctly; however, the third stage malfunctioned and the test was a failure. The Taepodong-1 is no longer considered operational in North Korea and was thought to be a technology demonstrator for the Taepodong-2.

Another IRBM in the North Korean arsenal is the Musudan. The Musudan — also known as the Nodong-B or the Taepodong-X — has a speculated range of 2,500 to 4,000 km and an estimated payload capacity of 1,200 kg. The likely targets of the Musudan missile are U.S. bases in the Pacific, like Guam, Okinawa, and Japan. North Korea first tested the Musudan in 2016, conducting a total of eight tests that year. Of these tests, only one was confirmed to be successful. U.S. sources estimate that North Korea has fewer than 50 Musudan and Taepodong-1 IRBM missiles.

On May 14, 2017 North Korea completed its first successful test of a new missile, the Hwasong-12, firing on a lofted trajectory to avoid flying over neighboring countries and to test the missile's reentry vehicle. During the test, the Hwasong-12 flew for around 30 minutes to an altitude of over 2,000 km and travelled approximately 787 km before landing in the Sea of Japan.

North Korea's first successful test launch of the Musudan missile on June 22, 2016.

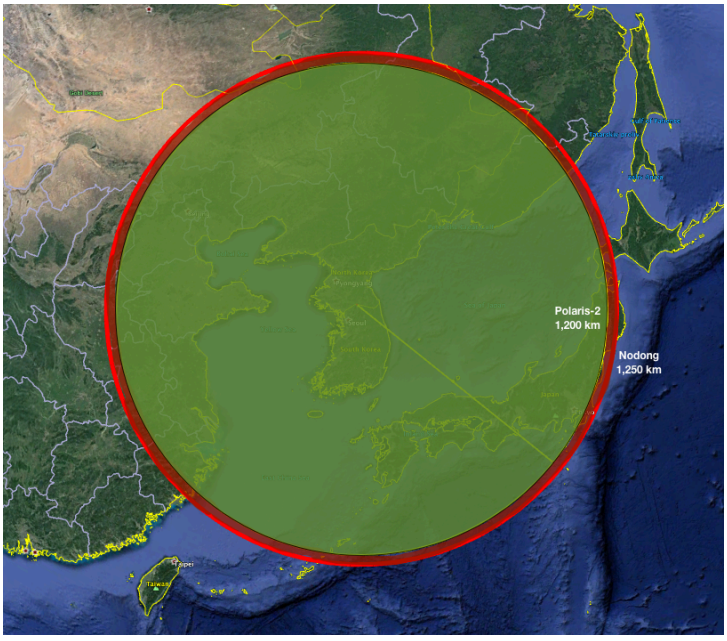
Test launch of the Hwasong-12 on September 15, 2017.

Experts speculate that if the missile was fired at a standard trajectory, it could have traveled more than 4,000 km. More recently, on August 29 and September 15, North Korea test launched the Hwasong-12 missile directly over Japan. The missile launched on August 29 reached an altitude of 550 km and flew over 2,700 km before breaking apart into three pieces during the final stage of flight, possibly indicating the failure of a newly implemented post-boost vehicle (PBV). The missile launched on September 15 reached an altitude of 770km and flew over 3,700 km before landing in the Pacific Ocean. These two tests of the Hwasong-12 are significant because they are the first time North Korea flew a missile designed specifically to carry a nuclear warhead over Japan. Previous missiles that have flown over Japan, North Korea stated were space-launch vehicles. The Hwasong-12 represents a significant step forward for North Korea's missile program and is the most advanced North Korean IRBM seen to date; potentially serving as a technological precursor to North Korea's KN-08 intercontinental ballistic missile prototype.

MEDIUM-RANGE BALLISTIC MISSILES (MRBMS)

In the late 1980s, Pyongyang began developing the Nodong missile, also known as the Rodong or the Hwasong-7, based on the Scud design. The missile has an estimated range of 1,350-1,600 km and a payload capacity of about 1000 kg. U.S. sources estimate that the DPRK has around 50 deployed Nodong missiles. Japan is the likely target of the Nodong; however, it is believed that the medium-range ballistic missile (MRBM) is relatively inaccurate, having a "circular error probable" of 2 to 4 km. The Nodong is assumed operational, and it is believed that the MRBM was tested in 2006, 2009, 2014, and 2016. In 2016, a salvo of three Nodong missiles were fired and all three missiles landed in the Sea of Japan inside of Japan's exclusive economic zone (EEZ). North Korea's Nodong MRBM could potentially be used to strike anywhere in South Korea or Japan.

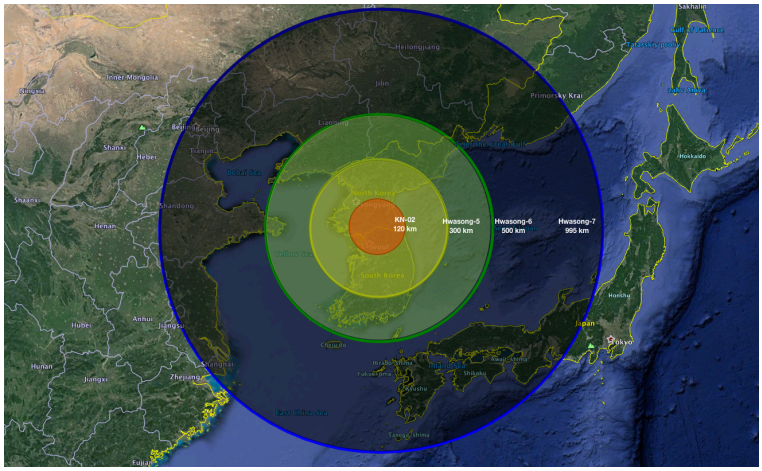
Test launch of the Polaris-2 on February 12, 2017.



The ranges of North Korea's MRBMs.

On February 12, 2017, North Korea successfully tested a land-based variant of its Polaris-1 submarine-launched ballistic missile. Called the Polaris-2, this land-based variant is cold-launched, meaning the missile is expelled out of a tube by gas produced by a gas generator which is not part of the missile itself, and then the missile ignites. The Polaris-1 uses solid fuel with an estimated range of 1,200 km. The Polaris-2 was successfully tested again on May 21, 2017. The Polaris-2 represents a drastic advancement in North Korea's road-mobile ballistic missile capability, because its solid propellant and cold-launch capability increase the missile's mobility and stability; two factors that increase the challenges associated with tracking its location. Also notable, is that the Polaris-2 was launched from a tracked transporter erector launcher (TEL), which limits the necessity for smooth, paved roads and instead allows the missile to be launched from hidden, off-road sites.

SHORT RANGE BALLISTIC MISSILES (SRBMS)



The ranges of North Korea's SRBMs.

The Kim regime possesses a variety of short-range ballistic missiles (SRBMs) and the U.S. estimates that North Korea deploys fewer than 400 Scud missiles. Specifically, the isolationist state is believed to currently employ five types of SRBMs: the KN-02, the Hwasong-5, Hwasong-6, Hwasong-9, and the KN-21.

The KN-02 has a range of up to 120 km and is operational, putting military installations in South Korea at risk. Like the Polaris-1, the KN-02 is a solid-fueled missile believed to have a payload capacity between 250 and 500 kg. The first test of the missile, in April 2004, was a failure. Since 2004, the KN-02 has been tested at least 20 times, most of them successful, and became operational between 2006 and 2008.

Other SRBMs employed by North Korea are the Hwasong-5 and the Hwasong-6, both of which were developed with Soviet assistance in the 1970s and 80s and are speculated to have been tested and deployed. The Hwasong-5—also known as the Scud-B—has a range of 300 km and the Hwasong-6—also known as the Scud-C—has a range of 500 km. It is believed that Pyongyang sold the Hwasong-6 to Iran, where it is known as the Shahab 2.

The Hwasong-9, or Scud-D/Scud-ER, was developed indigenously by North Korea. It is believed to have a range between 800 and 1000 km, and a payload capacity of around 500kg. It can carry chemical or high explosive warheads, and even possibly has the capacity to be fitted with miniaturized nuclear warheads. All North Korea's Hwasong SRBMs have the range to strike targets anywhere in South Korea and in some parts of southern Japan.

The KN-21 is suspected to be a variant of North Korea's first missile, the Hwasong-5 (Scud-B). The KN-21 SRBM is a unitary, scud missile with a non-separating warhead that give it the capability to maneuver in the terminal phase of flight. North Korea has described this missile as an 'ultra-precision' variation of its existing SRBMs. This missile was first flight tested on August 25, 2017, when North Korea launched three KN-21s in 10-minute intervals. The second missile blew up immediately after launch, but the first and third missiles flew around 250km before falling into the sea.

Salvo launch of four Scud-ER ballistic missiles on March 6, 2017.

SUBMARINE LAUNCHED BALLISTIC MISSILES (SLBMS)

The DPRK has a submarine-launched ballistic missile (SLBM) called the Pukkuksong-1 — also known as the Polaris-1 or KN-11 — that is still in development. In early 2016, state media footage released by North Korea showed the testing of an SLBM, likely the KN-11. However, the tests are reported to have been unsuccessful. In August 2016, North Korea again conducted a test launch of the KN-11, which showed a significant improvement in North Korea's SLBM program as the KN-11 flew over 500km into Japan's air identification zone. Based on the August 2016 flight test, experts estimate that the KN-11 has a maximum range of 1,200 km and believe the KN-11 could be fully operational by 2020.

On August 23, 2017, photos released by North Korea showed diagrams of new missiles that may be in development. One diagram was of a new missile called the Polaris-3 (Pukkuksong-3). Based on the diagram, the Polaris-3 appeared to be a two-stage, solid-fueled SLBM.

To complement its developing SLBM program, North Korea is also working on developing and deploying a submarine capable of launching ballistic missiles. Currently, North Korea has one Sinpo class experimental submarine in service, which can hold and launch one ballistic missile. However, the Kim regime is believed to be working on building a bigger submarine that could carry multiple ballistic missiles at a time. The August 2016 successful test of a North Korean SLBM was likely launched from the Sinpo class submarine, demonstrating a significant increase in North Korean submarine technology.

Test launch of the Polaris-1 on April 23, 2016.

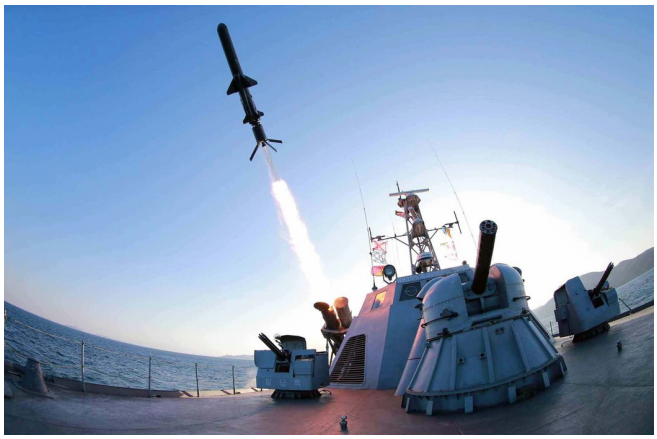
Kim Jong-un observes as a KN-11 SLBM is loaded into the Sinpo class submarine.

CRUISE MISSILES

North Korea possesses two known cruise missiles, both of which are purposed for anti-ship operations: the KN-01 and the Kumsong-3. Both cruise missiles are based on Russian missile designs, which North Korea either directly or indirectly acquired. Both missiles provide Pyongyang with a capability, albeit limited, to threaten U.S. and allied vessels operating near the Korean Peninsula.

The KN-01 is an anti-ship cruise missile (ASCM) with an operational range of 110-160km. In February 1993, the KN-01 had its first flight test and has been tested nearly 20 times since then. Currently the cruise missile is launched from the ground, but has the potential to be adapted for launch from the sea. The most recent test in June 2015 utilized a new integrated turbojet engine, indicating continued efforts to improve this missile.

The Kumsong-3, also known as the KN-19, is considered a coastal defense cruise missile (CDCM) based on the Russian-designed KH-35 anti-ship cruise missile. This CDCM is capable of being ground- or sea-launched and has been tested twice since its initial display in 2014. The February 2015 test launch was fired from a patrol boat, whereas the missiles in the June 2017 test were ground-launched.



Test launch of the Kumsong-3 on February 7, 2015.

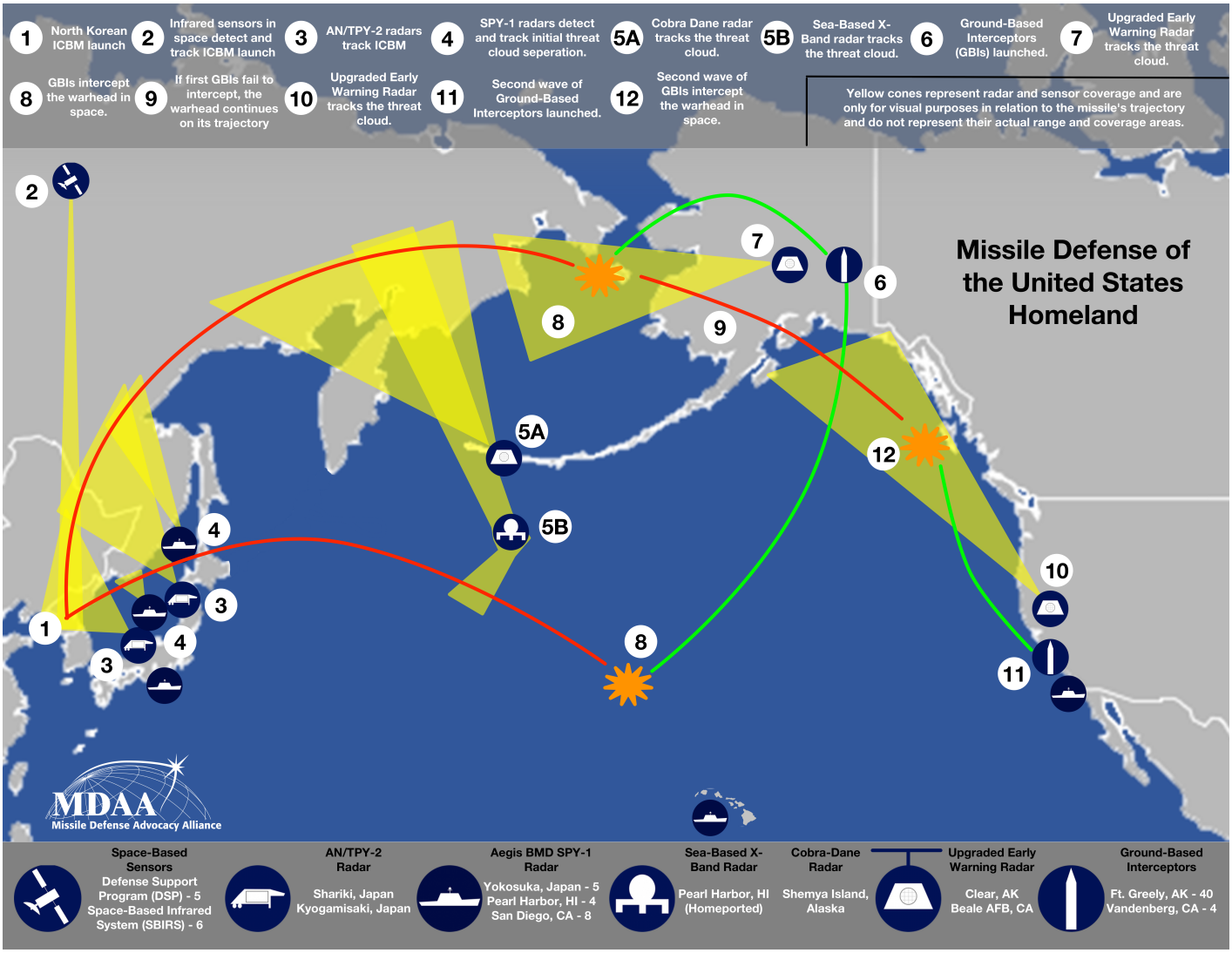
Test launch of the Kumsong-3 on June 8, 2017.

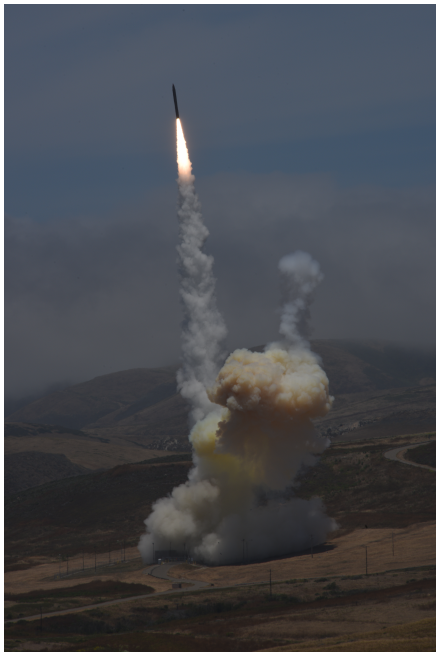
ADDRESSING THE THREAT

United States

The United States deploys a variety of sensors and missile interceptors to defend against short, medium, intermediate, and intercontinental-range ballistic missiles. A particularly important element of the ballistic missile defense (BMD) system is the ground-based interceptors (GBI) deployed in Alaska and California as part of the Ground-based Midcourse Defense system (GMD). GMD is the only system capable of defending the homeland against long-range ballistic missile threats from North Korea and employs sensors and interceptors designed to track, engage, and destroy intermediate and long-range ballistic missile threats. The U.S. currently deploys 44 GBIs in California and Alaska, each equipped with an Exoatmospheric Kill Vehicle (EKV) that serves as the intercept component of the GBI.

On May 31, 2017, the Missile Defense Agency (MDA) conducted the first ever GMD intercept test of an ICBM target missile. During the test, a single GBI fired from Vandenberg Air Force Base (AFB), California intercepted the target missile. In a House Armed Services Committee (HASC) hearing on June 7, 2017, then director of MDA Vice Admiral Syring stated, "The scenario that we conducted was actually an exact replica of the scenario that this country would face if North Korea were to fire a ballistic missile against the United States." Currently, the EKV is in the process of being updated as the Redesigned Kill Vehicle (RKV) to meet the growing threat posed by North Korea. The RKV is a next-generation kill vehicle designed to increase reliability, the ease of assembly, enhance performance, and lower costs. The U.S. is also developing a Multi-Object Kill Vehicle (MOKV) that will be able to target and destroy several objects in space using advanced sensors, guidance systems, and propulsion and communication technologies.





A GBI is launched during the May 30, 2017 intercept test.

In addition to modernizations of the kill vehicles, the U.S. is also improving the radar and sensors used as part of the BMD System. The Long-Range Discrimination Radar (LRDR), currently in development, is a high-powered S-band radar with the ability to acquire, track, and discriminate ballistic missile threats. The LRDR will better distinguish between warheads, decoys, and debris. Phase one of construction for the LRDR began during the 2017 Fiscal Year at Clear AFB, Alaska. Improved discrimination and tracking data provided by the LRDR, expected to be operational by 2020, increases the effectiveness of GBIs and reduces the number of interceptors needed to counter ICBMs.

While U.S. GBIs have multiple intercept opportunities to defend Alaska and the continental United States during an ICBM attack from North Korea, there is only one opportunity for GBIs in Alaska and California to intercept a missile targeting Hawaii. Due to North Korea's nuclear tests in 2016 and 2017, as well as its continuing development and testing of ballistic missiles that can strike Hawaii and the mainland United States, the U.S. is considering adding to its missile defense network in the Pacific. Specifically, U.S. officials are considering transforming the Aegis Ashore test site in Hawaii, which has a vertical launch system capable of launching Standard Missile-3 (SM-3) interceptors, into a combat-ready facility that would add an extra layer of protection for the islands.

During the same June 7, 2017 HASC hearing previously mentioned, Vice Admiral Syring also stated, "We have not tested it yet, [but] there is inherent capability within the SM-3 Block IIA to engage longer-range threats in terms of what we believe the design space is. We have not tested against the longer-range threat, but analysis indicates that could add another layer of defense to Hawaii." Moreover, MDA in its Fiscal Year 2018 budget proposal requested funding to begin development of a Homeland Defense Radar – Hawaii (HDR-H) that would have an initial operational capability by Fiscal Year 2023 and would increase the discrimination capability for GBIs defending the Hawaiian Islands.

Intercept test of the Aegis Ashore site at PMRF

Top: GBI being lowered into its silo
Bottom: MOKV Concept Art

U.S. Territories

The U.S. Territory of Guam is a little over 3,400 km from North Korea, putting it within range of Pyongyang's intermediate-range ballistic missiles. To counter the threat, the United States deployed a Terminal High Altitude Area Defense (THAAD) battery to Guam in April 2013 following North Korea's third nuclear test. The THAAD battery, which is now permanently stationed in Guam, works with Aegis BMD ships in the Pacific to provide the island with a layered defense. On July 11, 2017, MDA conducted the first THAAD intercept test against an IRBM target missile, which resulted in a successful intercept. On July 30, THAAD maintained its perfect intercept record of 15 out of 15 tests, with another successful intercept against an MRBM target.

Terminal High Altitude Area Defense system launches an interceptor.

The need to protect Guam from the threat posed by North Korea is great given Guam's strategic importance in the Pacific. Guam is home to Anderson Air Force Base and Naval Base Guam, which allow the United States to maintain military force readiness in the region. On several occasions, the U.S. deployed nuclear-equipped strategic bombers from Anderson AFB to fly over South Korea in a show of support for the alliance and deterrence following several of North Korea's nuclear and ballistic missile tests. Naval Base Guam is also a homeport for four fast-attack submarines that deploy throughout the Pacific. The ability to defend Guam and the U.S. forces there from North Korean ballistic missiles would be especially important during times of crisis when the U.S. needs to protect the people and weapons stationed there to be able to retaliate and protect other deployed forces.

South Korea and Japan

While North Korea poses a significant threat to the U.S. homeland and U.S. territories in the Pacific, the threat is even greater for U.S. allies in the region such as Republic of Korea (ROK) and Japan. South Korea's capital, Seoul, a city of just over 10 million, is just 35 miles from the border with North Korea and the entire country is within range of North Korea's short-range and medium-range ballistic missiles. South Korea is also vulnerable to the North's use of weapons of mass destruction, which includes chemical, biological, and nuclear weapons.

To counter the North Korean threat, South Korea has hosted missile defense systems since the United States stationed the 1st Battalion, 43rd Air Defense Artillery in the ROK in 1994 in response to North Korea's threats to suspend the armistice on the Korean Peninsula. South Korea develops and upgrades its defenses in response to North Korean provocations and technological developments. In response to North Korea's 2006 nuclear test, South Korea announced it would create its own indigenous missile defense system, the Korean Air and Missile Defense System (KAMD). In May 2007, the ROK Navy launched the Sejong the Great (DDG 991), its first Aegis-equipped guided missile destroyer. The ROK commissioned two more ships in November 2007 and June 2011. All three ships were produced jointly by the United States and South Korea.

South Korea currently deploys Patriot PAC-2 and PAC-3 batteries, Israeli-made Green Pine land-based radar systems, and three KDX-III Class Aegis Destroyers equipped with SPY-1D(V) radar. Following the DPRK's nuclear test in January 2016, the United States and the ROK reached an agreement for the U.S. to deploy the THAAD system to the peninsula. In April 2017, the U.S. deployed two THAAD launchers and a TPY-2 radar to Seongju County, South Korea, but the deployment of four additional THAAD launchers was halted pending an environmental study. However, after North Korea's 6th nuclear test on September 3, 2017, South Korea allowed the four additional THAAD launchers to be deployed on a temporary basis pending the completion of the full environmental assessment. On September 7, 2017, the four additional THAAD launchers were deployed to Seongju County.

The deployment of THAAD to South Korea provides the ROK with a layered and reliable missile defense system to counter against short, medium, and some intermediate-range ballistic missiles launched by North Korea. The United States had sought to deploy THAAD in South Korea for several years, but South Korea showed reluctance given China's opposition to the missile defense system on the Korean Peninsula. Since the talks between the U.S. and the ROK began in early 2016 and through the deployment of THAAD, China has continued to voice its opposition and criticize the move, even imposing unofficial sanctions on South Korea. Chinese objections to the deployment of THAAD to the peninsula are in part to the AN/TPY-2 radar system used by THAAD to detect missiles, which has a coverage area that includes large portions of mainland China and could monitor Chinese missile activities.

THAAD arrives in South Korea.

Japan is also within range of North Korea's short, medium, and intermediate-range ballistic missiles and its investment in missile defense is fueled by the erratic behavior and technological developments of the Kim regime. Japan and the United States have a long history of cooperation in the realm of ballistic missile defense and the two countries collaborate to research, develop, and deploy missile defense systems. In 1998, North Korea launched a Taepodong-1 missile that flew over Japan before landing in the Pacific Ocean. This test and subsequent missile and nuclear weapons tests reignited Japan's interest in deploying missile defense systems. Japan currently deploys a layered defense system consisting of Kongo-class Aegis destroyers, Patriot PAC-3 batteries, and AN/TPY-2 radar systems to protect the country from a myriad of North Korean ballistic missiles. Following North Korea's test of two Hwasong-14 ICBMs in July 2017, Japan announced its plans to expedite the purchase and deployment of the Aegis Ashore missile defense system by 2023. Additionally, Japan plans to increase its total number of Aegis BMD ships from four to eight by 2020 and is seeking to acquire the new U.S. SPY-6 radar system, which is still in development.

Pyongyang's improving nuclear and ballistic missile capabilities pose a significant threat to South Korea, Japan, and the United States. To counter this growing North Korean threat, these nations have chosen to deploy integrated missile defense systems, building cooperation and trust with one another in the process. As the DPRK continues to develop its nuclear and ballistic missile capabilities, this cooperation, sharing of information, and deployment of integrated missile defense systems will become even more important.