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Contents

Introduction

In 2025, there are more satellites and systems in space than ever before, providing numerous services, information, and capabilities to people worldwide. The European Space Agency (ESA) and more than 10 countries, including North Korea, have the ability to launch their own satellites, and more than 90 countries are active in space, with over 2,900 satellites launched in 2023 alone.[1] Many of these systems are for civilian purposes and are built and operated by private companies, not governments.

Alongside this private sector focus on space, there is a growing trend within NATO and in many individual countries to recognize outer space as a warfighting and operational domain. Countries are developing anti-satellite (ASAT) weapons that hinder the utilization of space by others. For example, China and Russia conducted destructive direct-ascent (DA) ASAT tests targeting their own satellites in 2007 and 2021, respectively. Russia's 2022 invasion of Ukraine sparked even further governmental interest in space activities when SpaceX's Starlink satellite constellation provided a significant frontline advantage to Ukraine's military. Outer space is increasingly important—both economically and militarily—for many countries, and North Korea is no exception.

North Korea's space program dates back to the 1980s. The Democratic People's Republic of Korea (DPRK) has emphasized the development of space for peaceful purposes through manufacturing and launching of satellites as a symbol of advances in modern science and technology and national power. The country claims to be promoting science, technology, and economic growth through space development.[2] But the nation has other, less peaceful goals for its development of space: In

1987, then-leader Kim Jong-il ordered the acquisition of the capability to attack against the United States and the production of satellites, according to a former senior North Korean official.[3]

Since its first attempt to launch a satellite in 1998, North Korea has carried out nine more launches, successfully putting three satellites into orbit. Though the country has often emphasized its peaceful use of outer space, the United Nations Security Council considers these launches as a cover for the development of intercontinental ballistic missiles (ICBMs) and has imposed sanctions on Pyongyang in response. The sanctions seem not to have lessened the country's resolve, however, and North Korea has been openly testing ICBMs since 2017.

Kim Jong-un, who came to power in 2012, announced his intention for North Korea to develop space science and technology and to launch more advanced satellites—including communication satellites—under the strategic line of carrying out economic construction and building nuclear armed forces simultaneously.[4] North Korea introduced its first five-year plan for space development in 2012 and its second in 2016, indicating its intention to launch many more satellites, including earth observation and geostationary satellites.[5]

North Korea's space program became even more active following the 2021 announcement of a five-year plan for the advancement of defense science and the development of weapon systems, including the acquisition of information, surveillance and reconnaissance (ISR) capabilities.[6] Following a successful reconnaissance satellite launch in 2023, Kim Jong-un declared that the country had both an "eye" that could see and a "fist" that could strike across the world, implying the joint use of reconnaissance satellites and ICBMs against adversaries such as the United States.[7]

Current North Korean satellite imagery is not of a high enough resolution to make a significant contribution to the country's military capabilities.[8] However, the war in Ukraine has precipitated a renewed relationship between Russia and North Korea, and their ties related to space technologies have strengthened. Since the imposition of sanctions on Russia following its invasion of Ukraine, experts believe that Russia has probably provided North Korea with missile technology and components, and in return Russia has received DPRK-manufactured munitions.[9] Russian assistance could enhance North Korea's space capabilities in the coming years.

Furthermore, North Korea remains skilled in electronic warfare and cyberattacks, including a November 2024 South Korean military reconnaissance drone crash caused by North Korean GPS interference and a May 2024 cyber operation targeting aerospace and defense companies.[10] In addition to committing financial crimes that provide revenue for the country's missile development programs, North Korea's cyber operations are used to gather information on adversaries' space technologies, including missile systems and satellite technology.[11]

This report outlines the history of North Korea's space program, the country's space and counterspace capabilities, and its relationships with Russia, China, and Iran. It includes a discussion of the objectives of North Korea's space launches and satellite operations. It also examines North Korea's future space developments and the potential threat they poses to the international community.

A Brief History of North Korea in Space

China established diplomatic relations with the United States in 1979, and in the 1980s, China deepened the relationship due to their mutual cooperation against the Soviet Union.[12] At the same time, the Soviet Union and the Gorbachev administration also improved its relations with the United States, bringing about the end of the Cold War in 1989.[13] As a result, the reliability of the China-North Korea and the Soviet-North Korea alliances as deterrents against the United States declined. Some analysts have suggested that these shifting geopolitical dynamics led North Korea to acquire the current state's war-deterrence and war-readiness capabilities by manufacturing its own satellites and weapons instead of relying on its allies for them.[14]

After overcoming the technical difficulties of multistaging, engine clustering, guidance, airframe design, and development, as well as the economic turmoil that it was facing in the 1990s, North Korea made its first attempt to place a satellite into orbit in 1998. The launch was conducted at the Tonghae Satellite Launching Ground on the country's east coast, on a variant of the Taepodong-1, an intermediate-range ballistic missile (IRBM).[15] Although North Korea claimed to have successfully orbited a satellite, the United States believed the launch failed.[16] Two other failed launches took place from the Tonghae launch site in July 2006 and April 2009, using Taepodong-2, the successor to the Taepodong-1, and Unha-2, a launch vehicle believed to be a variant of the Taepodong-2.[17]

In April 2012, after the establishment of the Kim Jong-un regime, North Korea attempted another launch that failed, this time using the Unha-3, another launch vehicle believed to be a variant of the Taepodong-2, from the newly completed Sohae Satellite Launching Ground on the country's west coast.[18] In December 2012, the country successfully orbited its first satellite using the Unha-3 rocket,

but signals from the satellite were never independently observed. In February 2016, North Korea successfully placed a second satellite into orbit, again using the Unha-3 rocket, but again, satellite signals were never detected.[19]

The country's 2021 announcement of a five-year plan aimed at advancing defense science—including the development of weapons systems and technology for military reconnaissance and information-gathering—marked an even more active stage for North Korea's space program.[20] In April 2022, Kim Jong-un inspected North Korea's official space agency, the National Aerospace Development Administration (NADA), and the Sohae Satellite Launching Ground, emphasizing the strategic importance of reconnaissance satellites in enhancing the state's war-deterrence and war-readiness capabilities.[21]

In November 2023, North Korea successfully launched its first military-reconnaissance satellite, the Malligyong-1, into orbit on the Chollima-1, which has a larger payload than the earlier Unha rockets, following two failed launch attempts in May and August 2023.[22] Following the successful launch, Kim Jong-un stated the country would launch three additional military spy satellites in 2024.[23]

Table 1: North Korean Satellite Launch Attempts

Date	Carried Rocket	Satellite	Launch Site	Launch Results
August 1998	Called Taepodong-1	Kwangmyongsong-1	Tonghae	Third stage failed
July 2006*	Called Taepodong-2	-	Tonghae	First stage failed
April 2009	Unha-2	Kwangmyongsong-2	Tonghae	Third stage failed
April 2012	Unha-3	Kwangmyongsong-3	Sohae	First stage failed
December 2012	Unha-3	Kwangmyongsong-3 Unit 2	Sohae	Success (No satellite signals detected)
February 2016	Unha-3	Kwangmyongsong-4	Sohae	Success (No satellite signals detected)
May 2023	Chollima-1	Malligyong-1	Sohae	Second stage failed
August 2023	Chollima-1	Malligyong-1	Sohae	Third stage failed
November 2023	Chollima-1	Malligyong-1	Sohae	Success
May 2024	"New-type satellite carrier rocket"	Malligyong-1-1	Sohae	First stage failed

Source: Tianran Xu, "Surpass the Cutting Edge: Reflections on North Korea's Failed May 27 Satellite Launch," 38 NORTH, June 7, 2024, https://www.38north.org/2024/06/surpass-the-cutting-edge-reflections-on-north-koreas-failed-may-27-satellite-launch/.

*Some believe that the 2006 launch was likely a ballistic missile test or a suborbital launch.[24]

The DPRK attempted another launch with a new engine in May 2024, but engine problems resulted in launch failure. The new rocket was the first North Korean space-launch vehicle (SLV) powered by cryogenic liquid oxygen (LOX)-kerosene propellants, analysts said. LOX-kerosene is the most popular combination for SLVs such as the Russian Soyuz and the U.S. SpaceX Falcon-9.[25] According to a South Korean official, prior to the May 2024 launch, many Russian technicians had entered North Korea, and Russian technology transfer may have facilitated North Korea's choice of LOX-kerosene engines.[26] Since then, North Korea has not attempted further launches, although modernization of the Sohae Satellite Launching Ground, including the construction of new roads, has steadily continued.[27]

North Korean Space Policy and Organizations

Starting in the 1980s, the Korean Committee for Space Technology (KCST) was responsible for the DPRK space program. The KCST oversaw research, satellite manufacture and launch, and management of the country's rocket launch sites. The existence of the KCST was not revealed until it was first mentioned in North Korea's state media shortly before the launch of the Kwangmyongsong-2 in 2009.[28]

In the 1990s, North Korea's space program was carried out in secret under the codename "Moonlight Project," but no specific plans or goals were known.[29] North Korea developed the Taepodong-2 alongside its Taepodong-1, and in the 2000s, developed the Unha rocket.

At the time of the announcement of its first five-year plan for space development (2012), KCST officials had said that they planned to develop an earth observation satellite followed by a geostationary satellite and a SLV larger than the Unha-3 rocket, possibly referring to the Kwangmyongsong satellites and the Chollima rockets, respectively.[30] In 2013, Kim Jong-un announced that the country would develop space science and technology and launch more advanced satellites including communication satellites, under the strategic umbrella of economic construction and building nuclear armed forces.[31] In 2016, North Korea launched its second five-year plan for space development, indicating its intention to launch multiple practical satellites, including geostationary satellites, but it did not conduct any satellite launches until May 2023.[32]

The international community condemned North Korea's space launches, considering them linked to the country's ballistic missile program. Following the December 2012 launch of the Unha-3 rocket,

the UN Security Council declared the flight a violation of the ban against North Korean ballistic missile tests and imposed a round of international sanctions on the KCST.[33]

It is unclear if the sanctions were the trigger for Pyongyang to enact its Law on Space Development, adopted in 2013 at the 7th Session of the 12th Supreme People's Assembly. Possibly to boost the legitimacy of the country's space program, the law emphasizes the development of space for peaceful purposes and North Korea's adherence to the principle of Juche, the state ideology of self-reliance. State media reported that the law (1) established NADA, the country's central guidance institution organizing all space development projects, (2) reinforced the principles of notification, security, investigation, and compensation related to satellite launches, and (3) called for international cooperation on space projects, but provided no further information.[34]

A UN panel of experts concluded that NADA would inherit or incorporate functions previously performed by the KCST. NADA's name and logo are similar to NASA's, and South Korean media argued that by modelling NADA's image on the U.S. agency, North Korea was appealing for legitimacy and criticizing perceived double standards.[35]

The Workers' Party of Korea (WPK) Congress adopted a five-year plan in 2021 to advance defense science and to develop weapon systems, explicitly aiming to secure reconnaissance and information-gathering capabilities based on military reconnaissance satellites, and to promote solid-fuel ICBMs and advance nuclear technology.[36] Kim Jong-un noted that the purpose of developing and operating military reconnaissance satellites is to provide the armed forces of North Korea with real-time information on military actions against it by the United States, South Korea, and Japan.[37]

North Korea revised its Space Development Law in 2022, amending it to link space development efforts to national defense, clearly establishing its space program as a military endeavor for military purposes.[38] Article 1 of the revised law includes language about "contributing to strengthening the nation's defensive strength," and Article 3 highlights the "self-defensive national defense power" aspect of space development. Article 2 specifically excludes research rockets and ballistic missiles from its definition of "space objects," and Article 4 mandates compliance with international safety standards for launching and operating space vehicles.[39]

In 2023, the country's 14th Supreme People's Assembly reorganized the space agency and renamed it, yet again, to the National Aerospace Technology Agency (NATA).[40] A high-ranking North Korean source claimed that NATA's reorganization was in part intended to facilitate greater technological cooperation with Russia. NATA is thought to be in charge of North Korea's space development, including the development and operation of SLVs and satellites, as well as its aviation development, including military helicopters, drones, and civilian aircraft.[41] The Academy of National Defense Science, which is involved in the country's ballistic missile and nuclear weapons programs, is also engaged in the design of launch vehicles and satellite equipment.[42]

North Korea is a signatory to several international space treaties. In March 2009, the DPRK signed two UN space treaties: the Outer Space Treaty of 1967 and the Convention on Registration of Objects

Launched into Outer Space of 1974, likely attempts to bolster its argument that its satellite program is peaceful.[43] North Korea also acceded to the agreements on the rescue of astronauts, the return of astronauts and objects launched into space, and the convention on international liability for damage caused by space objects in February 2016.[44] Additionally, North Korea has proposed joining the United Nations Committee on the Peaceful Uses of Outer Space, but its participation in the forum has been blocked by countries including the United States and its Western allies.[45]

Sanctions Against North Korea

The United Nations Security Council (UNSC) imposed sanctions on North Korea in 2006 after Pyongyang's first nuclear test, and has toughened sanctions every time Pyongyang has stepped up its development of nuclear weapons and missiles since then. A series of UNSC resolutions obligate North Korea to (1) not conduct any further launches that use ballistic missile technology, nuclear tests, or any other provocation; (2) immediately suspend all activities related to its ballistic missile program as well as nuclear-related activities; and (3) abandon all nuclear weapons, existing nuclear programs, and any other existing weapons of mass destruction and ballistic missile programs in a complete, verifiable, and irreversible manner.[46]

Although there are differences between ballistic missiles and SLVs in terms of payload and flight configuration, they are structurally similar. Both use powerful rocket engines, high-strength and lightweight airframes, inertial navigation and guidance units, stage- and payload-separation mechanisms, and tracking and telemetry systems.[47] Following the December 2012 launch of the Unha-3 rocket, the UNSC imposed a round of international sanctions on the KCST, declaring the flight a violation of its ban.[48]

Although the technology used in SLVs may have contributed to ICBM development in the early stages, experts argue the usefulness may be limited.[49] Reconnaissance satellites not only provide North Korea with better intelligence on military movements in neighboring countries but also improve the targeting capabilities of ICBMs and help to assess damage in a conflict.[50] For this reason, the international community must continue to block North Korea's access to essential funding and technology for its space and military programs.

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Despite these concerning developments, the UNSC's sanctions regime against North Korea has been weakening since the council's last adopted resolution against Pyongyang in December 2017. In May 2022, Russia and China vetoed a U.S.-drafted UNSC resolution to strengthen sanctions on North Korea following the latter's repeated ballistic missile tests in violation of previous UN resolutions.[51] In March 2024, Russia voted against the renewal of a UN expert panel charged with monitoring the implementation of sanctions against North Korea.[52] The United States, other countries, and international bodies—including U.S. allies Australia, Japan, and South Korea, and the European Union—have imposed separate sanctions that complement and reinforce the UN sanctions, increasing pressure on North Korea.[53]

North Korea's Space Capabilities

Space capabilities are essential for a modern military and modern warfare. Satellites provide global communications, command and control, navigation, precision targeting, missile defense, and persistent battlespace awareness. Countries are investing heavily in the development of space launch vehicles to carry satellites into orbit, with the aim of improving the reliability, cost, and payload capacity of SLVs. This section compiles and assesses publicly available information on the space capabilities being developed by North Korea across three categories: (1) SLVs, (2) space launch facilities, and (3) satellites.

Space Launch Vehicles

Ballistic missiles and SLVs both use powerful rocket engines, high-strength and lightweight airframes, inertial navigation and guidance units, and stage- and payload-separation mechanisms.[54] However, while ballistic missiles fly in a parabolic trajectory and release a warhead that reenters Earth's atmosphere, SLVs reach a certain altitude before taking a flat trajectory and projecting a satellite into orbit. The U.S. ballistic missiles Atlas and Titan, the Russian ballistic missile SS-25, and the Chinese ballistic missile Dongfeng-5 were all repurposed from ballistic missiles into SLVs, and North Korea's SLVs were developed the same way.[55]

In 1981, North Korea is believed to have imported from Egypt the Scud B, a short-range liquid fuel propulsion ballistic missile manufactured in the then-Soviet Union with a firing range of approximately 300 km.[56] In the 1990s, North Korea developed the Taepodong-2 alongside its Taepodong-1, and in the 2000s, it developed the Unha rocket, a variant of the Taepodong-2, both

of which are thought to use the liquid-fuel engines derived from the Scud B.[57] In December 2012 and February 2016, the country successfully orbited its first and second satellites.

Following the dissolution of the Soviet Union, Russia established diplomatic relations with South Korea in 1990. As a result, Russia agreed to prevent its scientists from working on the North Korean missile program, and in a 1992 incident, a group of 32 Russian missile engineers were intercepted and arrested at Moscow's Sheremetyevo International Airport. However, U.S., Russian, and South Korean intelligence officials later concluded that some of the scientists did eventually succeed in traveling to North Korea to offer blueprints and technical advice for the DPRK missile program.[58] The development of the Taepodong and the Unha may thus have been supported by Russian experts.

North Korea's early satellites were primitive, weighing 100–200 kg. However, in order to launch more advanced satellites, it was necessary to develop larger rockets.[59] In its 2012 five-year space development plan, North Korea indicated its intention to develop just such a rocket.[60] Following two failed launches in May and August 2023, in November of the same year, North Korea successfully launched its first military reconnaissance satellite into orbit on the Chollima-1, which had a larger payload capacity than the earlier Unha rockets. Some experts believe that the Chollima-1 is powered by Paektusan engines, which are derived from the Soviet RD-250 family of engines and are also used in long-range missiles such as the Hwasong-17 ICBM.[61] Based on analyses of the design and other features of the Chollima-1, South Korea concluded that Russia helped North Korea put the 2023 satellite into orbit.[62]

Despite its successful launch, North Korea did not continue to use the Chollima-1, attempting another launch with a new engine in May 2024.[63] The Paektusan engine from the Chollima-1 uses liquid propellant that can be stored at room temperature, whereas the new engine uses a combination of LOX and kerosene fuel.[64] LOX-kerosene is the most popular combination for SLVs, including the Russian Soyuz and the U.S. Falcon-9.[65] Experts have offered various reasons for the switch from the successful Chollima-1, such as improvements in efficiency and performance, or an increase in payload capability for heavier satellites.[66] According to one South Korean official, prior to the May 2024 launch, many Russian technicians had entered North Korea, and Russian technology transfer may have facilitated North Korea's choice of LOX-kerosene engines.[67]

Since 2024, North Korea has not attempted further launches, but NATA has focused intensively on deficiencies in orbital deployment and high-resolution observation capabilities. With such support from Russia, North Korea may be able to launch a larger SLV, with payload capability for more advanced satellites, in the coming years.

Table 2: North Korea's Satellite Launch Vehicles

	Taepodong-1	Taepodong-2 (Unha-2, 3)	Chollima-1	"New-type satellite carrier rocket"
Length	25.0–32.0 m	32.0 m	Approx. 29.0 m	UNK
Diameter	1.4 m	2.4 m	Approx. 2.6 m	UNK
Launch Weight	20,700 kg	64,300 kg	UNK	UNK
Payload	750 kg	1,000–1,500 kg	UNK	UNK
Engine	Liquid-fuel engines derived from the Scud	Liquid-fuel engines derived from the Scud	The Paektusan liquid-fuel engine derived from the Soviet RD-250	New engines that use a combination of cryogenic liquid oxygen and kerosene fuel
Range	5,000 km	10,000 km	UNK	UNK

Source: "Missiles of North Korea," CSIS, last updated November 22, 2022, https://missilethreat.csis.org/country/dprk/; Vann H. Van Diepen, "First Flight of North Korea's "Chollima-1" SLV Fails, but More Launches and More New SLVs Are Likely," 38 North, June 7, 2023, https://www.38north.org/2023/06/first-flight-of-north-koreas-chollima-1-slv-fails-but-more-launches-and-more-new-slvs-are-likely/; Josh Smith, "New North Korean Space Rocket Features Engine From ICBMs, Analysts Say," Reuters, June 1, 2023, https://www.reuters.com/world/asia-pacific/new-north-korean-space-rocket-features-engine-icbms-analysts-say-2023-06-01; and Young-keun Chang, "The Truth Behind North Korea's New Satellite Launch Vehicles and Delayed Reconnaissance Missions," South And North Development, December 20, 2024, https://sand.or.kr/kr/opinion/plan.php.

Space Launch Facilities

North Korea has two launching areas for space capabilities: the Tonghae Satellite Launching Ground and the Sohae Satellite Launching Ground. The Tonghae site is North Korea's oldest ballistic missile and space launch facility and is located on the country's east coast. After North Korea's first attempt to launch a satellite in 1998, this facility hosted two more launch attempts—in July 2006 and April 2009. The Tonghae site has seen routine maintenance in the last decade, but no space launches have been reported at this facility since 2009, and a successful orbital launch has never been achieved at the facility.[68]

Driven by Tonghae's aging systems and suboptimal location, North Korea began construction of the Sohae Satellite Launching Ground on the country's west coast sometime in the 2000s, and completed work in 2011.[69] North Korea has also used the site to test engines for its ballistic missiles.[70]

In order to use energy efficiently to launch a satellite, rockets are generally launched eastward, the same direction as Earth's rotation; polar orbiting satellites are launched toward the south or north.[71] From the Tonghae Satellite Launching Ground, regardless of the direction of the launch, a satellite would fly over China, Russia, or Japan. The three launches from this facility were all eastbound, and two of them overflew Japan. In contrast, if a rocket is launched from the Sohae Satellite Launching Ground southward, it can avoid flying over the Japanese mainland. Furthermore, a northward launch from the Sohae site would enable a possible hit to the U.S. mainland.[72]

The Sohae facility hosted seven launch attempts, three of which survived to orbit.[73] In December 2012 and February 2016, the country successfully placed its first and second satellites into orbit, but signals were never independently observed.[74] North Korea began to dismantle the Sohae site in 2018, during the period of U.S.-North Korean rapprochement with the Trump administration, but after the February 2019 Hanoi summit talks ended in a stalemate, it rebuilt the facility.[75] In November 2023, North Korea successfully launched a military reconnaissance satellite following two failed attempts in May and August 2023. An attempt in May 2024 failed due to engine problems.[76] Though there have been no launches since the May 2024 failure, modernization of the Sohae site has continued into 2025.[77]

Figure 1: North Korea's Space Launch Sites and Launch Directions

Source: Defense of Japan 1998, (Tokyo: Japan Ministry of Defense, 1998), http://www.clearing.mod.go.jp/hakusho_data/1999/zuhyo/frame/az116006.htm; Defense of Japan 2009, (Tokyo: Japan Ministry of Defense, 2009), 40; Defense of Japan 2013, (Tokyo: Japan Ministry of Defense, 2013), 20; Defense of Japan 2016, (Tokyo: Japan Ministry of Defense, 2016), 28; and Defense of Japan 2024, (Tokyo: Japan Ministry of Defense, 2024), 118.

Satellites

In August 1998, North Korea made its first attempt to place a satellite—the Kwangmyongsong-1—into orbit. Although North Korea claimed that the launch was successful and that the satellite transmitted the melodies "Song of General Kim Il Sung" and "Song of General Kim Jong Il" and Morse code for "Juche Korea," the United States concluded that the launch failed.[78] In the

1990s, North Korean missile designers and engineers traveled to China for professional training and possible technology exchanges, and North Korea is believed to have received considerable assistance from the Chinese Academy of Launch Technology in the development of the Kwangmyongsong-1 and the subsequent Kwangmyongsong-2.[79]

In April 2009, North Korea again attempted (unsuccessfully) to launch the Kwangmyongsong-2 satellite.[80] In addition to transmitting the patriotic songs, the Kwangmyongsong-2 was meant to test the relaying of communications between different posts on the ground.[81] By using the Unha-2 rocket, larger than the previously used Taepodong-1, the payload capability increased, and the Kwangmyongsong-2 was equipped with a relay communications system, body mounted solar panels, and a two-axis control system.

On December 12, 2012, North Korea successfully launched its first satellite, the Kwangmyongsong-3 Unit 2, into low Earth orbit (LEO), following an earlier failed launch attempt in April 2012. The satellite was to transmit hymns and relay communications, as well as to perform Earth observation. The Earth observation mission included monitoring forest resources and natural disasters and assisting in food-crop planting and forecasting weather, all by using a low-resolution video camera on the satellite. The Kwangmyongsong-3 is more advanced than its predecessors: its three-axis stabilization system enables it to point the camera continuously at the Earth and two fold-out solar panels provide additional electricity for the imaging subsystem.[82]

On February 7, 2016, North Korea successfully launched its second satellite, the Kwangmyongsong-4, into LEO.[83] The country claimed that the measuring apparatuses needed for Earth observation were installed in the satellite, but details are unknown. Since both the Kwangmyongsong-3 and the Kwangmyongsong-4 orbited the Earth, including over the United States, some experts feared the satellites could pose an electromagnetic pulse (EMP) threat if they carried nuclear weapons, but there has been no evidence that they were nuclear-armed.[84] Despite successfully making it into orbit, the Kwangmyongsong-3 Unit 2 reportedly de-orbited on December 17, 2012, five days after launch, and the Kwangmyongsong-4 was reported to have decayed out of orbit as early as February 9, 2016, only three days after its launch.[85]

It is possible that these imagery collection satellites may have been intended not only for imaging Earth's resources, but also as cover for military reconnaissance missions.[86] The 2021 five-year plan included securing reconnaissance and information-gathering capabilities via military reconnaissance satellites, promoting solid-fuel ICBMs, and advancing nuclear technology.[87] Kim Jong-un noted that the purpose of developing and operating the military reconnaissance satellite is to provide the armed forces of North Korea with real-time information on military actions by the United States, South Korea, and Japan.[88]

Following two failed launch attempts in 2023, in November of that year, North Korea successfully launched its first military reconnaissance satellite, an imagery collection satellite named Malligyong-1, into a sun-synchronous orbit, a type of LEO frequently used for Earth observation satellites.[89] North Korea's state media reported that the satellite is operated from the Pyongyang General Control Center of NATA and that information obtained through the satellite's operations

would be reported to the Central Military Commission of the WPK. North Korea claimed that the satellite has photographed sensitive military and political sites in the United States (including the White House and the Pentagon), South Korea, and elsewhere, but has thus far not disclosed any images.[90]

According to a source in North Korea, the satellite was equipped with an electro-optical camera manufactured in Japan.[91] The resolution of the satellite is likely to be limited to a couple of meters, a range useful for identifying military installations and their general activity levels but insufficient for discerning or permitting the detailed identification and measurement of aircraft and missiles. It can be assumed that Pyongyang receives higher-resolution satellite imagery information from commercial and military sources in China and Russia, or possibly through computer hacking, so the current DPRK imagery satellite is unlikely to make a significant contribution to North Korean military capabilities.[92]

The signals from the Malligyong-1 were never independently observed, and it is unclear whether the onboard camera is actually taking images, though the satellite did maneuver in a series of steps to raise its perigee in mid-February 2024, a new development. These maneuvers are the first indication that a North Korean satellite has the ability to do basic station-keeping, revealing that Pyongyang is now able to actively prolong the orbital lifetimes of its satellites by doing periodic orbit raises.[93] In May 2024, North Korea again attempted to launch a military reconnaissance satellite, the Malligyong-1-1, considered an improved version of Malligyong-1, but the launch was unsuccessful.[94] Kim Jong-un said that the country would launch three more military spy satellites in 2024, but, as of publication, no launches have taken place.[95]

North Korea's satellites have progressed from playing patriotic songs to relaying communications to including an imaging system. However, the Malligyong-1 is still small for a military reconnaissance satellite, estimated to weigh around 300 kg, and the resolution of its imaging system is likely modest at best. Also, optical imagery has issues with cloud cover and imaging in the dark, so North Korea may seek to develop or acquire radar or infrared imaging satellites in the future.[96] Increasing satellite capability requires larger satellites and larger SLVs to put them into orbit. According to a North Korean source, NATA has focused intensively on deficiencies in orbital deployment and high-resolution observation capabilities, and it seeks Russian support in three key areas: (1) high-resolution sensor technology, (2) metals for small satellite production, and (3) improvements to delivery vehicle reliability and stability.[97] With support from Russia, North Korea may be able to improve its payload capability, and launch heavier satellites equipped with high-resolution sensors in the coming years.

NATA has focused intensively on deficiencies in orbital deployment and high-resolution observation capabilities, and it seeks Russian support in three key areas: (1) high-resolution sensor technology, (2) metals for small satellite production, and (3) improvements to delivery vehicle reliability and stability.

Table 3: North Korea's Satellites

	Kwangmyong-song-1	Kwangmyong-song-2	Kwangmyong-song-3	Kwangmyong-song-4	Malligyong-1
Dimensions	Approx. 0.4 m (72-faced tetrahedral)	0.75 x 0.75 x 1.1 m	0.75 x 0.75 x 1.1 m	UNK	1.3 m
Weight	30kg	Approx. 100kg	100 kg	Approx. 200 kg	Approx. 300kg
Sensors	None	Relay communi-cations system	Relay communi-cations system, video camera	Camera	Electro-optical camera
Resolution	None	None	100 m or greater (estimate)	UNK	Maximum 1 m
Power	Probably batteries	Body-mounted solar panels	2 folding solar panels	2 folding solar panels	4 folding solar panels
Stabilization	None	Probably 2-axis control	3-axis control stated	UNK	Probably low-thrust electric thrusters, 3-axis control
SLV	Called Taepodong-1	Unha-2	Unha-3	Unha-3	Chollima-1

Source: Hansen, "North Korea's Satellite Program;" Williams, "KMS 4"; Jeongmin Kim, "Unsuccessful Launch of a North Korean Reconnaissance Satellite," NK News, June 2, 2023, https://vpk.name/en/724967_unsuccessful-launch-of-a-north-korean-reconnaissance-satellite.html; and Chang, "The Truth Behind North Korea's New Satellite Launch Vehicles and Delayed Reconnaissance Missions."

North Korea's Counterspace Capabilities

The growing use of and reliance on space for national security has led more countries to look at developing counterspace capabilities that can be used to deceive, disrupt, deny, degrade, or destroy space systems. China in 2007 and Russia in 2021 conducted destructive direct-ascent ASAT tests targeting their own satellites. In the Russia-Ukraine war, electric warfare is playing a critical role in both offensive and defensive strategies, including jamming satellite communication and navigation signals.[98] This section compiles and assesses publicly available information on the counterspace capabilities being developed by North Korea across four categories: (1) kinetic weapons, (2) non-kinetic weapons, (3) electronic weapons, and (4) cyber operations.

Kinetic Weapons

Kinetic weapons are those that destroy or damage space systems through physical and material means, such as bombs, bullets, missiles, and other munitions. This includes DA-ASAT weapons with interceptors, and orbital ASAT weapons, which are placed into orbit and attack targets through a variety of means. To date, North Korea has not tested or indicated that it is attempting to develop a DA-ASAT or orbital ASAT capability. However, North Korea has multiple ballistic missile systems, including those in the IRBM and ICBM classes, which could possibly be used as the basis for future DA-ASAT capabilities.[99]

Non-Kinetic Weapons

Non-kinetic weapons use radiated energy to destroy, damage, or interfere with space systems. This energy can be directed, such as with laser or microwave energy, or distributed through nuclear detonations or electromagnetic pulse (EMP) events. Some reports highlight the potential for North Korea to place a nuclear weapon on a long-range missile or satellite, giving the country the capability to create a high-altitude EMP (HEMP) effect.[100] In a HEMP attack, the warhead would detonate above the atmosphere with an area of effect that can extend over a radius of hundreds of kilometers, inflicting widespread damage not only to satellites but also to electric grids and electronic systems on the ground.[101]

In 2004, two retired Russian generals said that the design for Russia's Super-EMP nuclear weapon was accidentally transferred to North Korea by Russian scientists and engineers working on DPRK missile and nuclear weapons programs. Although there has been no recent reported activity to indicate that North Korea is actively pursuing that capability, a HEMP attack does not require an accurate guidance system or a reentry vehicle, and experts believe that a HEMP attack is well within North Korea's current technological capabilities.[102]

Electronic Weapons

Electronic weapons include jamming and spoofing of global navigation satellite system (GNSS) and satellite communication (SATCOM) signals. Jamming uses radio-frequency energy to block signals to or from satellites. North Korea continues to conduct downlink jamming operations across the peninsula. In March 2024, for example, North Korea attempted to jam GPS signals during South Korean military exercises, the first reported use of GPS jamming by the country in eight years.[103] North Korea again jammed GPS signals for several days in late May 2024.[104] Furthermore, a South Korean military reconnaissance drone reportedly crashed in November 2024 due to GPS interference by North Korea, and, in January 2025, South Korea's defense ministry reported that North Korea's GPS jamming had persisted for over three months.[105] North Korea may also be developing uplink jammers that are effective against satellite communications, but to date, there is no public evidence of such development, testing, or use.

Spoofing is a form of electronic attack where an attacker tricks a receiver into believing that fake signals or fake coordinates produced by the attacker are real. North Korea continues to use automated identification system (AIS) spoofing for its ships to disguise its own illicit movements by transmitting a false identity and/or location to law enforcement, port and trade authorities, and other ships.[106] GPS problems, including GPS spoofing in South Korean airspace, were observed in May 2024, and South Korean military authorities identified North Korea as the source of interference.[107]

Cyber Operations

Cyber operations can include any offensive activity in cyberspace that targets space systems, including ground infrastructure, satellite terminals, spaceports, and spacecraft. Cyber operations

can not only destroy or permanently disable a targeted system, but can also be used to temporarily disrupt systems or to conduct espionage, including by gaining access to proprietary or sensitive technical information on a targeted network.

In addition to committing financial crimes that provide revenue for the country's missile development programs, North Korea's cyberattacks are also used to gather information on space technologies including missile systems and satellite technology.

While North Korea's cyberattacks have not been specifically targeted at space systems as of publication, they do demonstrate North Korea's continued focus on developing more sophisticated and viable cyber capabilities. For example, a June 2024 cyberattack targeted energy and aerospace companies, and another in May 2024 targeted aerospace and defense companies.[108] In addition to committing financial crimes that provide revenue for the country's missile development programs, North Korea's cyberattacks are also used to gather information on space technologies including missile systems and satellite technology.[109]

Regional Relationships

Russia, China, Iran, and North Korea are increasing their support for one another. U.S. Space Command is concerned about those four countries' increasing cooperation in space, noting that their growing ties adds a layer of complexity to a space domain that is growing more and more contested.[110] This section compiles and assesses publicly available information on the political, economic, diplomatic, and technological cooperations between North Korea and Russia, China, and Iran.

Relations with Russia

Since the mid-1990s, Russia has pursued a strategy of diplomatic "equidistance" between North Korea and South Korea.[111] Moscow agreed to prevent Russian scientists from working on the North Korean missile program, and in 1992, prevented a group of 32 Russian missile engineers from leaving the country. However, Russia's 2022 invasion of and subsequent war in Ukraine has precipitated a renewed relationship between Russia and North Korea, and the ties between the two on space technologies have strengthened.

Since the imposition of sanctions on Russia following this invasion, experts believe that Russia has provided missile technology and components, food and fuel shipments, and spare parts for its Soviet-era military equipment to North Korea. In exchange, Russia has received North Korean-manufactured munitions, which have been used in Ukraine.[112]

In September 2023, Kim Jong-un traveled to Russia's Far East, where he met with Russian President Vladimir Putin. Before their talks, the two leaders toured assembly and launch facilities at the Vostochny cosmodrome, where Kim was briefed on technical details of Russian space vehicles.[113] Putin told reporters that Russia would help North Korea develop its satellite capabilities.[114] Moreover, according to a South Korean official, prior to the May 2024 launch of a rocket with a new engine, many Russian technicians had entered North Korea.[115]

In June 2024, on his first visit to North Korea in 24 years, Putin signed a mutual defense treaty with Kim Jong-un. According to the treaty, North Korea and Russia will "immediately provide military and other assistance using all available means if either side is in a state of war."[116] In October 2024, North Korea sent about 10,000 troops to Russia to train and fight in the Ukraine war.[117] The treaty also states that North Korea and Russia will "develop exchanges and joint research in science and technology including space."[118] After Putin's visit to North Korea, the country switched the transmission of state TV broadcasts from a Chinese satellite to a Russian one.[119]

The relationship between North Korea and Russia could be temporary, largely driven by Russia's ongoing conflict in Ukraine, but support from Russia may enable North Korea to launch a larger SLV and more advanced satellites with high-resolution sensors, and may give North Korea greater confidence to conduct aggressive diplomatic or military actions to achieve its objectives in the coming years.

Relations with China

China is North Korea's biggest trade partner: In 2022, trade volume between China and North Korea accounted for over 95 percent of North Korea's total trade.[120] Many key components of rocket parts have been manufactured in Western countries and transported to North Korea by Chinese distributers.[121] In July 2024, the U.S. Department of the Treasury sanctioned a network of six individuals and five entities based in China that were involved in the procurement of items supporting DPRK ballistic missile and space programs.[122]

China is also a vital political partner for North Korea, and maintains a degree of influence on Pyongyang. The Sino–North Korea Treaty of Friendship, Cooperation, and Mutual Assistance, signed in 1961, is still in effect, and was the only formal defense treaty Pyongyang had with any other country until June 2024, when Vladimir Putin and Kim Jong-un inked the previously mentioned comprehensive agreement.

Military technological cooperation between North Korea and China dates back more than 50 years. In the late 1960s, the country turned to China to facilitate its missile efforts due to the deterioration of North Korea-Soviet relations, and in the 1970s, North Korea and China had a wide-ranging military agreement for the acquisition, development, and production of modern weapon systems, including a liquid-fueled ballistic missile. In the 1980s, China provided assistance to North Korea in areas of engine design and production, metallurgy, and airframe design in the development of the Hwasong-5, the first ballistic missile to reach true production status within North Korea.[123]

In the 1990s, North Korean missile designers and engineers traveled to China for professional training and possible technology exchanges, and North Korea is believed to have received considerable assistance from the Chinese Academy of Launch Technology in the development of the Kwangmyongsong-1 and the subsequent Kwangmyongsong-2 satellites.[124] However, there is no evidence that technical support from China has continued into 2025.[125]

Relations with Iran

Iran and North Korea have cooperated in the development of missiles and other military technologies over a long period, starting in the 1980s. North Korean-Iranian cooperation began as a transactional relationship, where Iran provided North Korea with cash in return for missile parts and technology.[126] Iran acquired Scud missiles from North Korea during the Iran-Iraq War in the 1980s, and it went on to obtain the North Korean Nodong and Musudan medium-range ballistic missiles (MRBMs) in the 1990s and 2000s, respectively.[127] Iran's Shahab-3 MRBM was developed based on North Korea's Nodong.[128] Experts have noted that Iran's Khorramshahr MRBM also resembles North Korea's Musudan.[129]

The transactional relationship has developed into an increasingly effective partnership. In September 2012, Iran and North Korea signed a Civilian Scientific and Technological Cooperation Agreement that included setting up joint laboratories, an exchange program for scientific teams, and technology transfers in the fields of information technology, engineering, biotechnology, renewable energy, and the environment. This agreement served as a conduit for North Korea to obtain Russian long-range missile technology via Iran, analysts said.[130]

Additionally, in 2016, the U.S. Treasury Department revealed that Iran's primary liquid-propellant missile entity, the Shahid Hemat Industrial Group (SHIG), was cooperating with North Korea in the development of a new 80-ton rocket booster.[131] SHIG officials had previously attended the launch of the Unha rocket in North Korea in 2012.[132] According to a UN expert report released in February 2021, SHIG's Shahid Haj Ali Movahed Research Center received "support and assistance" from North Korean missile specialists for a SLV.[133]

In April 2024, as the region witnessed mounting tensions amid the Israel-Hamas war, a North Korean delegation led by the cabinet minister for international trade visited Iran. This was the first visit to Iran by a North Korean official since August 2019. This most recent trip raised speculation that, along with economic cooperation, North Korea may be seeking to deepen military ties with Iran amid Russia's war with Ukraine and Iran-Israel tensions, although the Iranian foreign ministry has dismissed such speculation.[134]

Conclusion

Support from Russia may enable North Korea to launch a larger SLV and more advanced satellites with high-resolution sensors, giving North Korea greater confidence to conduct aggressive diplomatic or military actions to achieve its objectives in the coming years.

So far, the international community has underestimated North Korea's ambitions and has been repeatedly betrayed by its overly optimistic estimates. When North Korea unilaterally declared itself a nuclear power in 2005, many people believed that this was just a tactic to gain support from the international community, as there was no way that a poor, isolated country like North Korea could build nuclear weapons. Since then, however, North Korea has conducted six nuclear tests and is now believed to have achieved miniaturization in its nuclear warhead development. North Korea's satellites have become progressively more advanced, while the reliability and payload capacity of the country's SLVs have steadily improved. North Korea will continue to focus on orbital deployment and high-resolution observation capabilities in order to secure reconnaissance and information-gathering capabilities through military reconnaissance satellites.

Support from Russia may enable North Korea to launch a larger SLV and more advanced satellites with high-resolution sensors, giving North Korea greater confidence to conduct aggressive

diplomatic or military actions to achieve its objectives in the coming years. It is necessary for the international community to not only keep a close eye on the progress of North Korea's space capabilities—such as its payload capacity and sensor performance, and the technology transfers from Russia—but also to properly implement sanctions against the procurement of items from China that support North Korea's space program, and to prevent cyber operations aimed at obtaining funds and technical information for the DPRK space program.

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