### 1AC---Plan

#### Plan: The Republic of Korea should ban the appropriation of outer space by private entities.

#### South Korea’s space industry is fueled by the private sector – tech transfers and official statements.

**Si-Soo 21** [Park Si-Soo, 9-8-2021, Park Si-soo covers space industries in South Korea, Japan and other Asian countries. Park worked at The Korea Times — South Korea's leading English language newspaper — from 2007 to 2020. He earned a master’s degree in science journalism from Korea Advanced Institute of Science and Technology and a bachelor’s degree in business from Hanyang University. "South Korea to spend $593 million on public-to-private transfer of rocket technologies," SpaceNews, <https://spacenews.com/south-korea-to-spend-593-million-on-public-to-private-transfer-of-rocket-technologies/> accessed 1/12/2022] Adam

SEOUL, South Korea – Starting next year, South Korea’s government will transfer state-owned space launch vehicle technologies to domestic aerospace companies in a move to help them penetrate an expanding global space launch market. To that end, the government will spend 687 billion won ($593 million) from 2022 through 2027, [said the Ministry of Science and ICT, Sept. 7.](https://www.msit.go.kr/bbs/view.do?sCode=user&mId=113&mPid=112&pageIndex=&bbsSeqNo=94&nttSeqNo=3180691&searchOpt=ALL&searchTxt=)

Korea Aerospace Research Institute (KARI) — a state-run space technology developer that has played a central role in developing the nation’s first domestic space launch vehicle, KSLV-2 — will be responsible for the public-to-private transfer, according to the ministry. KSLV-2, nicknamed Nuri, is a three-stage liquid-propellant rocket capable of sending a 1.5-ton satellite into low Earth orbit. The rocket is set to make its first demonstration flight in October from Naro Space Center in Goheung, the only launch site in South Korea.

The transfer will be done in a way KARI and selected companies do joint development and launch tests.

“The time has come to make a departure from state-led development of space launch vehicles toward one in which the private sector plays an expanded and more active role,” said [Yong Hong-taek, the science ministry’s vice minister,](https://english.msit.go.kr/eng/contents/cont.do?sCode=eng&mPid=19&mId=22) in the statement.

The policy reconfirms the government’s commitment to accelerating public-to-private transfer of space technologies. It comes as SpaceX and other innovative private companies play increasingly important roles in the global space industry. In the first move of this kind, since May, KARI and Korea Advanced Institute of Science and Technology (KAIST) have transferred their satellite-manufacturing technologies to a handful of major aerospace companies here.

While the science ministry didn’t  identify the companies that would benefit from the latest tech transfer, the most likely beneficiaries include [Hanwha Aerospace](https://spacenews.com/hanwha-aerospace-bets-big-on-space-business/), [Innospace](https://biz.chosun.com/industry/company/2021/08/26/B73DAPWKMBFAHCPFK2ME6NM6H4/?utm_source=naver&utm_medium=original&utm_campaign=biz), [Perigee Aerospace](https://spacenews.com/backed-by-samsung-south-korean-startup-perigee-aims-for-2020-maiden-launch/) and [Korean Air](https://spacenews.com/south-koreas-top-airline-to-develop-propellant-tank-for-smallsat-launcher/).

Hanwha is a major rocket engine developer here, which contributed to KSLV-2’s development with engine assembly and supply of key components. Innospace is a hybrid rocket startup, and Perigee is developing a methane-fueled smallsat launcher. Korea Air, South Korea’s biggest airline, is developing technologies to launch small satellites from its Boeing 747-400 cargo planes — the same way Virgin Orbit launches customers’ satellites into orbit.

### 1AC---Missiles

#### Soko complicates the space race---sends a signal to noko and allies.

Clarke et al. 21 (, C., Lee, S. and Woolnough, M., 2021. China isn't the only nation preparing for war in space. A small neighbour flew 'under the radar'. [online] Abc.net.au. Available at: <https://www.abc.net.au/news/2021-10-22/korea-china-india-space-race-military-flex/100547832> [Accessed 12 January 2022] Carrington Clarke is the ABC's Seoul Correspondent, covering East Asia for the network. He works across digital, television and radio. He's held a range of roles at the ABC including as a reporter with ABC Investigations, the flagship current affairs television program 7.30 and as a reporter and presenter with The Business. He previously worked at SKY News as a reporter and presenter. Before making the transition to journalism he worked as an economist.)-rahulpenu

Asia is in the midst of a space race, but it's not just about exploration. It's also a military flex

The space race has never purely been about planting a nation's flag on an object in space or benign scientific discovery. It's always had a military and strategic dimension. For almost half a century, as the US and Russia competed for dominance above Earth, both superpowers spent billions exploring space weapons, like death rays fired from rocket ships. Yet while the cold war ended some 30 years ago, some fear that a new space race may be a sign the world is poised to enter another arms race too. This time, however, it won't just be limited to global superpowers. "The reality is that militarisation — and, if you like, democratisation — of space technologies, means that there are going to be more and more entrants into the area," said Brett Biddington, a space policy expert based in Canberra. "The rocket that can launch a nuclear weapon is very, very similar to the rocket that can launch a satellite to do observations for weather." Today, the pool of countries deploying huge amounts of cash to stake out their claims in the skies above is growing larger. China, India and Japan have already started to demonstrate both the ambition and technological skills necessary to be considered space powers. This week, **South** **Korea** revealed that it too wants to be taken seriously on the global stage, **refusing** **to** **be** **left** behind in the race to space. The launch of the gleaming South Korean space rocket Nuri, the first fully domestically produced space launch vehicle, was supposed to be a moment of national pride for the country. The result was mixed. The rocket launched successfully but the dummy satellite it carried didn't make it into orbit. Still, South Korean President Moon Jae-in promised a "**Korea** **space** **age**" and said his country's ambitions would not be thwarted. How South Korea 'flew under the radar' While its neighbour North Korea is more widely known for its nuclear weaponry, South Korea has been quietly working on **developing** its own **military** **capability**. In recent years, the country has increased its military spending, earmarking roughly $US85 billion ($113 billion) in funding for arms improvements between 2020 and 2024. But Dr Biddington said the launch of Nuri was a significant milestone for South Korea because "launching a launch vehicle is a really difficult thing to do". "South Korea has a long and quite distinguished space heritage. It set up its space agency in 1989," he said. "I feel like it's been flown under the radar, so to speak. "It's just quietly developed capabilities and used those capabilities without wanting to unduly upset any of its neighbours." Dr Biddington suggested the launch was also a sign that **South** **Korea** **now** wants to **assert** its **independence** not only **to** its **rivals** but also to its **allies**. "It's also a **message** **to** the neighbours of Korea, maybe **North** **Korea** especially," he said. "But also it's a comment to Japan and to China and to Russia, and even the United States that Korea has quietly and patiently developed capabilities that allow it to stand on its own two feet when it comes to its interest in outer space."

The space race and the arms race

**Nuri's** launch comes at a **time** **of** **heightened** tensions **in** the region with a full-blown arms race in action. Koreans have become accustomed to projectiles being launched from their peninsula. On Thursday, North Korea showed off its new Submarine Launched Ballistic Missile (SLBM) only a month after South Korea had shown off its own version. But it's not just confined to the peninsula, with reports this week suggesting China had tested a new 'hypersonic missile' that utilises space rocket technology to create a potentially devastating weapon. China dismissed the reports but Chang Young-keun, a missile expert at the Korea Aerospace University, said it was almost certain what China deployed was a weapon. "They definitely tested a hypersonic vehicle, not a space rocket," he said. Against such a backdrop, South Korea is not hiding that its space program has major military implications. "When we improve our civilian space technology, we also improve our military space technology," said Professor Chang. This week the country welcomed hundreds of international delegates to its major arms fair, the Aerospace and Defence Expo or ADEX. It was jam-packed with theatrics: Fighter jets manoeuvring overhead, drawing giant love hearts in the sky with their contrails as delegates below chowed down on **smoky** **Texas** **grill** and **burgers**. South Korean President Moon Jae-in made his own surprise visit to the event in the back of a fighter jet, urging the country to redouble its efforts to become a global defence leader. "The goal of building strong defence power is always to foster peace," he told the crowd.

The benefit of a space race

South Korea may not yet have its own dedicated 'Space Force' like the US, but it has made clear that **space** is **crucial** **to** its **defence**. However, there are also legitimate civilian and scientific motivations for its ambitions for a space industry. South Korea's capacity to launch its own rockets is a critical step for reaching goals like a national 6G cellular network and a sovereign radio navigation system like the American GPS. Lee Hyung-mok, who is a professor emeritus in physics and astronomy at Korea National University, said he and his fellow scientists were excited about the opportunity to use these rockets. He said they will help transport observation equipment outside the earth's atmosphere, allowing them to better understand our universe. Such a discovery doesn't come cheap and Professor Lee said he recognises that space travel can be expensive. He also said he knows that national defence is often an easier way to get the government to loosen the public purse strings. "Maybe the government decided to spend a huge amount of money because of the military importance," he said. Although competition might be spurring further investment in space, he still worries about where it might lead. "What I really hope is that instead of competing too much, it's better to collaborate," he said. "So in many areas, they try to work together." But he said within Asia, no-one is in that "mood" yet.

#### Space is the linchpin for Seoul’s missile development---targets Noko, severs US allied-interdependence, raises serious nuclearization concerns, and modernizes the entire missile force.

---guideline revision has made development possible for the first time, specifically entities

---they target noko

---tech becomes v good

---empirics---soko did the same thing in the 2017 guideline revision but the revision was a lot less major

---destroys the alliance

Panda 20 (, A., 2020. Solid Ambitions: The U.S.–South Korea Missile Guidelines and Space Launchers. [online] Carnegie Endowment for International Peace. Available at: <https://carnegieendowment.org/2020/08/25/solid-ambitions-u.s.-south-korea-missile-guidelines-and-space-launchers-pub-82557> [Accessed 13 January 2022] Ankit Panda is the Stanton Senior Fellow in the Nuclear Policy Program at the Carnegie Endowment for International Peace. An expert on the Asia-Pacific region, his research interests range from nuclear strategy, arms control, missile defense, nonproliferation, emerging technologies, and U.S. extended deterrence. He is the author of Kim Jong Un and the Bomb: Survival and Deterrence in North Korea (Hurst Publishers/Oxford University Press, 2020). Panda was previously an adjunct senior fellow in the Defense Posture Project at the Federation of American Scientists (FAS) and a member of the 2019 FAS International Study Group on North Korea Policy. He has consulted for the United Nations in New York and Geneva on nonproliferation and disarmament matters, and has testified on security topics related to South Korea and Japan before the congressionally chartered U.S.-China Economic and Security Review Commission. Panda was a Korea Society Kim Koo Fellow, a German Marshall Fund Young Strategist, an International Institute for Strategic Studies (IISS) Shangri-La Dialogue Young Leader, and a Carnegie Council on Ethics in International Affairs New Leader. He has worked at the Council on Foreign Relations and the Liechtenstein Institute on Self-Determination at the Princeton School of Public and International Affairs. A widely published writer, Panda’s work has appeared in the New York Times, the Washington Post, Foreign Affairs, Foreign Policy, the Bulletin of the Atomic Scientists, the Diplomat, the Atlantic, the New Republic, the South China Morning Post, War on the Rocks, Politico, and the National Interest. Panda has also published in scholarly journals, including Survival, the Washington Quarterly, and India Review, and has contributed to the IISS Asia-Pacific Regional Security Assessment and Strategic Survey. He is editor-at-large at the Diplomat, where he hosts the Asia Geopolitics podcast, and a contributing editor at War on the Rocks.)-rahulpenu

Solid Ambitions: The U.S.–South Korea Missile Guidelines and Space Launchers

Seoul’s missile activities have long been constrained by decades-old limits that South Korea agreed on with its longtime ally, the United States. At various junctures, these limits have gradually been loosened, though the latest such change may not upset the regional security balance as much as it may appear to at first blush.

Most recently, following nine months of negotiations, the United States and South Korea agreed to further revise these bilateral missile guidelines in the summer of 2020. On July 28, 2020, South Korean Deputy National Security Adviser Kim Hyun-chong announced that, pursuant to the **newly** **agreed** **revisions**, South Korean individuals and **entities** will **be**, **for** the **first** **time**, **capable** **of** “developing, producing, and possessing” space launch vehicles (**SLVs**) making use of solid rocket motors **without** **restrictions**. Kim went on to announce, “As of July 28, 2020, limits on the use of solid fuel in space launch vehicles are completely removed.”

The decision opens a new era for South Korean space launch activities and has raised questions about possible **military** **applications** for large-diameter solid rocket boosters. While these technologies hold economic promise for a country that seeks to scale its space program quickly, they can also contribute to a long-range **missile** **program**. Ballistic missiles that use solid propellants are generally more operationally nimble than their liquid-propellant counterparts and, as a result, can be more militarily useful.

The revised guidelines were announced during the start of a new era of possible missile proliferation in the Asia-Pacific region, and these revisions coincide with a deteriorating geopolitical environment amid growing U.S.-China frictions. Moscow’s and Washington’s scrapping of the 1987 Intermediate-Range Nuclear Forces Treaty in 2019 has introduced the possibility of new U.S. short- and intermediate-range conventional missile deployments in Asia.[1] Meanwhile, Japan and Australia are both exploring standoff strike capabilities to better deter perceived threats, China continues to expand its large arsenal of conventional and dual-capable missiles, and North Korea keeps on qualitatively refining and quantitatively expanding its missile capabilities. The revised U.S.–South Korea guidelines have sparked some concerns that Seoul may harbor other motives beyond facilitating civilian spacefaring activities and that this revision may ultimately set up Seoul for a longer-range, more capable missile **arsenal**.

But a closer look at South Korea’s objectives suggests the July 2020 guideline revisions are not what should really draw attention. Instead, Seoul’s **indigenous** ballistic missile **programs**, which have continued apace under gradually slackening bilateral guidelines over the years, should be the primary focus. South Korea’s Agency for Defense Development (ADD) is already pursuing capabilities, within the confines of a prior revision to the guidelines, that open up new missile possibilities for Seoul and that may **heighten** the odds of **misperceptions** in the region.

EARLIER REVISIONS TO THE GUIDELINES

The U.S.–South Korea missile guidelines have been revised before. The July 2020 decision represents the third significant revision to the forty-one-year-old guidelines—originally agreed upon in a classified 1979 bilateral understanding—in the last decade. In 2012, a previous conservative South Korean government, led by then president Lee Myung-bak, clinched an agreement allowing Seoul to develop ballistic missiles capable of delivering 500-kilogram payloads to ranges of up to 800 kilometers (sufficient to strike all of North Korea from Daegu, a southern city in South Korea). Seoul had requested the range extension to augment its autonomous strike capabilities following twin provocations in 2010: a North Korean torpedo sunk a South Korean corvette, ROKS Cheonan, and North Korean artillery shelled the South Korean–controlled Yeonpyeong Island.

The 2012 revision followed a 2001 extension of the original 180-kilometer range limit to 300 kilometers. This earlier revision was linked to Seoul’s accession to the Missile Technology Control Regime (MTCR), a cartel of states capable of producing technologies necessary for manufacturing advanced ballistic missiles; at that time, this revised limit matched the regime’s Category I range and payload limits.

Fast-forwarding to the near present, in 2017, the administration of U.S. President Donald Trump, amid breakneck North Korean qualitative advances in missile technology, reached an agreement with South Korean President Moon Jae-in’s administration to eliminate the payload weight limit entirely while maintaining the 800-kilometer missile range restriction. Yet none of these revisions had affected South Korea’s space launch technologies—until the July 2020 announcement.

SOUTH KOREAN SOLID PROPELLANTS

Until now, South Korean indigenous SLVs have relied on liquid-bipropellant combinations that would be poorly suited for anything but orbital launches. For instance, the Korea Aerospace Research Institute’s (KARI) Nuri, also known as Korea Satellite Launch Vehicle-II (KSLV-II), employs liquid oxygen (LOX) and a kerosene variant as its oxidizer-fuel combination across all three missile stages. Cryogenic liquid oxidizers, like LOX, have several advantages, but major operational drawbacks in terms of their handling and storage have kept them from being used in modern ballistic missiles. First-generation U.S. and Soviet intercontinental ballistic missiles (ICBMs)—like the Atlas and the R-7, for instance—employed LOX, but their successors quickly moved to noncryogenic hypergolic liquid bipropellants before eventually settling on solid propellants.

**Solid** **propellants** for long-range, large-diameter rockets have a similar **appeal** when used for **orbital** and suborbital applications whether they are employed for civilian or military purposes. With the fuel cast directly into their airframes, solid rocket motors can be readied for use with considerably less pre-launch preparation, assuming proper handling and storage. (Proper storage and transportation of solid rocket motors are nontrivial considerations.) This characteristic makes solid propellants often preferable for **military** **applications**—especially for small-diameter missiles.

Solid fuels do have their drawbacks, however. For instance—unlike liquid-propellant engines, which can be remotely shut off—once ignited, solid-fuel engines will burn until all available fuel is consumed. Seoul’s presented rationale for pursuing solid-propellant SLVs does not rule out the possibility that new solid boosters may eventually be used as ballistic missiles, but the main focus for now is on enabling cheaper surveillance satellite launches.

Kim, South Korea’s deputy national security adviser, was quite open in his July press conference that Seoul envisages potentially using new, solid-propellant orbital launchers to send observation satellites into low-Earth orbit. “Theoretically, we can launch a low-Earth orbit satellite via liquid-fuel rockets, but it’s like delivering a dish of jjajangmyeon [a Korean noodle dish] by [way of] a 10-ton truck,” he added, apparently seeking to make the case for the economical nature of delivering smaller payloads in this manner.

This point bears emphasizing: it can be more economical for a space program to scale around solid rocket boosters, depending on the types of payloads and desired orbits. As South Korea looks to improve its indigenous intelligence, surveillance, and reconnaissance (ISR) capabilities against North Korea in the coming years, military surveillance satellites will come to play a more important role in South Korean military planning.

Such capabilities are also an important barometer for facilitating larger alliance goals, namely the transfer of wartime operational control (OPCON) from the U.S. military to South Korea’s own forces. The South Korean forces under the alliance’s Combined Forces Command have been led by U.S. military generals for some time, but Seoul has long aspired to regain the operational prerogative to lead these forces on South Korean soil in wartime. One of the conditions for such a transfer is that the South Korean military meet certain benchmarks when it comes to its military capabilities.

Addressing this point, Kim was open about Seoul’s desire to deploy such satellites into low-Earth orbit, but he also made clear that existing liquid propellant–based launch vehicles are uneconomical for this application. South Korea’s strategic goal, per Kim, is to realize persistent space-based surveillance of North Korea, granting Seoul what he referred to as an “unblinking eye.” In July 2020, the commercial firm SpaceX launched South Korea’s first exclusive military communications satellite, the Army Navy Air Force Satellite Information System-II (ANASIS-II).

Other countries make varied use of solid-propellant SLVs for varied payload delivery to low-Earth orbit when conducting commercial and state-run space activities. Liquid-propellant boosters can be more energetic and efficient, so they tend to be favored for most missions. In the United States, repurposed solid-fueled LGM-118 Peacekeeper ICBMs are used for delivering certain government payloads to low-Earth orbit. Similarly, China’s Kuaizhou-11 program is somewhat unique in how it uses a vehicle called a transporter erector launcher to facilitate mobile launches of light satellites (an approach that could be employed for purposes such as enabling the rapid replacement of satellites that may be lost to anti-satellite weapons during a conflict).

Future **launches** of surveillance satellites would **reduce** **Seoul’s** **dependence** on U.S. technical surveillance capabilities to monitor North Korean activities and help the South Korean military achieve conditions-based OPCON transfer.[2] (After several delays, the current timeline for such a transfer is set for 2022.) Shortly before the announcement of the updated guidelines, U.S. Secretary of Defense Mark Esper and his South Korean counterpart Jeong Kyeong-doo “expressed their unwavering support for a conditions-based OPCON transition, consistent with the bilaterally-agreed Conditions-Based OPCON Transition Plan,” according to a Pentagon statement.

The latest July 2020 revision to the guidelines will facilitate these goals and was largely driven by Seoul’s space-based ISR ambitions. However, some analysis on the latest revision suggests that Seoul may now seek to build larger-diameter, longer-range solid-propellant **rockets** to possibly hold at risk **targets** in **North** **Korea** and perhaps even in **China**. North Korea historically has been and continues to be the primary driver of South Korea’s missile program.

During previous rounds of bilateral consultations with the United States, South Korean officials sought to ideally win approval to possess 1,000-kilometer-range missiles—capable of reaching almost all of North Korea from the island of Jeju off the southernmost tip of South Korea. New, heavy-payload ballistic missiles already in development could range much farther than 800 kilometers with a lighter payload, so South Korea already technically possesses the capability to reach all of North Korea with a 500-kilogram payload. The chief constraint preventing Seoul from officially unveiling and deploying this capability remains the bilateral missile guidelines. Although Seoul could repurpose these capabilities to hold at risk targets in northern China and parts of eastern China, South Korea holds quite nuanced views of China and does not view it as a major categorical threat, making this outcome unlikely.

NEW SOUTH KOREAN BALLISTIC MISSILE DEVELOPMENTS

What should moderate any immediate concerns on the possible consequences of South Korea’s shift to solid-propellant SLVs is the primary concern **hiding** **in** **plain** **sight**. South Korea continues to develop solid-propellant ballistic missiles that are already capable of not only reaching all of North Korea but of doing so with **heavy** conventional **payloads**. The Hyunmoo-4 is an 800-kilometer-range system that entered testing for the first time earlier in 2020. Moon applauded it recently for exhibiting “close to the world’s heaviest warhead weight,” making full use of the 2017 update to the missile guidelines. While this missile is thought to feature a 2,000-kilogram payload, if it were to be launched with a payload half that weight, the Hyunmoo-4 would perform as a medium-range missile (using the U.S. government definition of missiles with ranges between 1,000 and 3,000 kilometers).

Little is known authoritatively about the Hyunmoo-4 beyond the fact that it entered testing this year. Its reported payload weight has appeared in multiple South Korean press reports and is consistent with the general direction of the Hyunmoo program under ADD’s auspices. For instance, the Hyunmoo-2C—also an 800-kilometer-range system, but with a smaller payload—was publicized during testing in 2017 at the height of tensions on the Korean Peninsula.

ADD emphasized the system’s earth-penetrating warhead and its **precision**. The suggestion was that this capability would be useful in striking tunnel-based missile launchers, hardened command-and-control targets in North Korea, or perhaps even Kim Jong Un himself. The Hyunmoo-4 appears to be a bigger and more explosive version of the Hyunmoo-2C: this new model is capable of executing that same mission against ever-harder targets that would necessitate more explosive power.

In the near term, South Korea is likely to continue investing in the **Hyunmoo**-4 program. This system represents the most **serious** **challenge** to the spirit of the principles that drove the missile guidelines, which were first implemented in 1979 and were primarily concerned with building confidence that South Korea could not build plausible nuclear-delivery systems. (Seoul’s indigenous nuclear weapons program had ended in the mid-1970s.)

The guidelines were designed—and updated in 2001 and 2012—with the understanding that it is reasonable to control missile capabilities by manipulating either payload or range limits. For a given payload constraint (500 kilograms, for example), extending range limits would allow Seoul to develop new boosters, but only to a point. With the scrapping of payload limits altogether in 2017, the Hyunmoo-4 was allowed to surface, raising the specter of possible longer-range South Korean systems. Seoul’s apparent acquisition of some components from older Russian ICBMs has left lingering concerns that South Korea may seek longer-range missile capabilities.

In today’s context, these concerns deserve to be taken seriously. Although South Korea continues to abide by its obligations under the Nuclear Non-Proliferation Treaty, and though its government leaders do not seek nuclear weapons, the growth of North Korean nuclear capabilities in the last five years combined with growing unease about the credibility of U.S. alliance assurances in the Trump era have renewed debates in **Seoul** on **pursuing** **nuclear** **weapons** capabilities in the future.

The **military** **balance** on the Korean Peninsula has **changed** **dramatically** since 1979, when South Korea’s missile ambitions outranged those of North Korea, which at the time had yet to flight-test its first Scud missiles. Despite this—in the spirit of the original 1979 guidelines, which sought to assuage concerns about South Korean nuclearization in the 1970s—Seoul should transparently help build confidence that its existing missile programs are no cause for concern beyond contributing to necessary conventional deterrence vis-à-vis North Korea. This confidence building would have salutary effects on regional stability amid intensifying geopolitical competition between the United States and China.

NEXT STEPS

South Korea’s expanding space launch ambitions, sealed by the July 2020 revisions to the bilateral missile guidelines, need not heighten Northeast Asian insecurity. Seoul’s interest in more economical space launch activities and an expanded space-based layer of military surveillance is understandable. South Korean measures to increase transparency, however, could reduce the chance of misperceptions about Seoul’s intentions. Similarly, South Korea could help build confidence around its ongoing missile programs.

To mitigate a worsening security dilemma with Pyongyang and potentially Beijing, Seoul should declare the scope of applications for government-sponsored research and development in larger solid rocket boosters. While publicizing existing capabilities, like the Hyunmoo-4, may be undesirable due to the current South Korean government’s inter-Korean diplomatic efforts, Seoul can do so without provocative messaging (such as threatening North Korea with decapitation attacks or strikes on hardened military sites).

Beyond this, South Korea should also transparently release plans for specific KARI-led civilian spacefaring projects and military satellites that may make use of larger solid-propellant boosters. Such transparency would reinforce Seoul’s stated plans and build confidence. At a higher level, the South Korean government should take steps to clarify its ongoing commitment to the terms of the MTCR and the Hague Code of Conduct Against Ballistic Missile Proliferation.

Meanwhile, as testing of the Hyunmoo-4 continues, South Korea should limit development on larger payload conventional missiles that could technically be compliant with the 800-kilometer-range restriction in the bilateral missile guidelines.

Separately, the United States and South Korea should work to build confidence in the region that the 2017 and 2020 changes to the guidelines will not adversely affect regional stability. To this end, they should open an ongoing bilateral consultative review of the missile guidelines. While Seoul is not seeking further changes to the guidelines, it would be productive for the allies to establish a semiannual or quarterly review of the guidelines and discuss related matters, including any issues of concern stemming from South Korean missile activities and civilian rocket research.

**South** **Korea** has seen its **security** **environment** **deteriorate** **sharply** over the last decade as its northern neighbor has reached significant missile and nuclear milestones. Meanwhile, political malaise over cost-sharing has begun to **seep** into the **foundations** **of** the bilateral **alliance** **with** the **U**nited **St**ates since 2017. In this environment, precision strike missiles and a robust, indigenous space-based constellation of military surveillance satellites can plug important perceived gaps in conventional deterrence and even hedge against plausible shifts in how the United States postures its forces on the Korean Peninsula.

But Seoul’s ability to now use solid-propellant boosters to deliver satellite payloads to low-Earth orbit should not be the primary concern in the short term. Given the already impressive capabilities embodied in the Hyunmoo-4 and its predecessor, South Korea has already made itself stand out as a leader in missile technology. But as Seoul embarks into a **new** **era** as a spacefaring nation, it should take precautions to dispel concerns about its intentions and work to build confidence while practicing effective deterrence against North Korea.

**North Korea sees the South’s launches as a double standard – that emboldens the regime and increases aggression.**

**Parry 21** [Richard Lloyd Parry, Richard Lloyd Parry has lived since 1995 in Tokyo, where he is the Asia editor of The Times. He has reported from 29 countries, including Afghanistan, Iraq and North Korea, and has been named Foreign Correspondent of the Year Asia Editor, 10-21-2021, "South Korea heightens tensions with space launch," The Times, [https://www.thetimes.co.uk/article/south-korea-heightens-tensions-with-space-launch-jb8mnwwdp accessed 1/12/2022](https://www.thetimes.co.uk/article/south-korea-heightens-tensions-with-space-launch-jb8mnwwdp%20accessed%201/12/2022)] Adam

South Korea launched a domestically built rocket into space today in a breakthrough that will embolden North Korean accusations of hypocrisy. The three-stage KSLV-II Nuri entered orbit after being launched from the Naro Space Centre on a small island off the country’s southwest coast, although it failed in its final task — putting into orbit a dummy satellite. Even so, it was a welcome half-success after years of setbacks and failures. The mission is likely to be seized upon by [North Korea](https://archive.is/o/a0crs/https:/www.thetimes.co.uk/article/north-korea-demands-end-to-joint-military-exercises-amid-further-missile-tests-hgwhg3jwf) as an example of double standards. Beginning in 1998 the North fired off a series of what it called civilian rockets, which were denounced by the US and South Korea as a front for developing long-range missiles. These predictions turned out to be correct and North Korea now has an arsenal of ballistic missiles, including weapons with the range to potentially strike the mainland United States. South Korea says its programme is intended for nothing more than launching civilian satellites. It was a nervous day for South Korea. In 2010 an earlier version of the Nuri exploded two minutes after take off, and until this afternoon the failure rate for the country’s rockets was 70 per cent. The launch was postponed by an hour as engineers checked valves in the rocket — among its three million separate parts. But just after 5pm local time the Nuri lifted off smoothly into clear skies and jettisoned its first and second stages on schedule. The launch confirms South Korea as only the seventh country in the world to have developed a domestic space vehicle that can carry a payload heavier than a tonne, after China, France, India, Japan, Russia and the United States. However, Nuri failed to launch its 1.5-tonne dummy satellite of steel and aluminium, which was supposed to have been placed into a low earth orbit of 600km to 800km. “It’s very difficult for newcomers to achieve this,” President Moon said at the Space Centre after the launch. “But we achieved it, with no help from other countries.” A version of the Nuri was successfully launched in 2013, though its first stage was manufactured in Russia. There is no immediate prospect that South Korea will convert its rocket technology to military use. It already has short and medium-range ballistic missiles although it is bound by an agreement with its US ally to limit these in range to 800km. Last month South Korea joined the small group of countries able to fire ballistic missiles from a submarine. With a range of 500km, the Hyunmoo 4-4 missile fired from a 3,000-tonne Dosan Ahn Chang-ho class submarine has all of North Korea within its range. But when North Korea carried out its [own submarine missile launch](https://archive.is/o/a0crs/https:/www.thetimes.co.uk/article/north-korea-tests-unidentifed-ballistic-missile-lw5fh0t8k) this week, the South expressed its “regret” and the US condemned the action. “To criticise [North Korea] for developing and test-firing the same weapon system as the one the US possesses or is developing is a clear expression of double standards and it only excites our suspicion about the ‘authenticity’ of its statement that it does not antagonise [North Korea],” a spokesman in Pyongyang said.

**Noko tensions in space spill over to war---emp, van allen, nukes, and turns every impact**

**Davis 17** (, M., 2017. North Korean nukes and space war | The Strategist. [online] The Strategist. Available at: <https://www.aspistrategist.org.au/north-korean-nukes-space-war/> [Accessed 12 January 2022] Dr Malcolm Davis Senior Analyst Contact information Contact information EXPERTISE Space Policy, Space Security, Strategy & capability development, future warfare and military technology & Chinese military modernisation.)-rahulpenu

North Korean nukes and space war

North Korea’s launch of a Hwasong-12 IRBM over Japan on 28 August, a second launch on 15 September (once again overflying Japan), and its test of what is either a boosted fission weapon or an early generation thermonuclear weapon on 3 September have accelerated the rush towards a major military crisis on the Korean peninsula. One aspect of North Korea’s nuclear developments that warrants closer attention is its ability to use nuclear weapons to generate electromagnetic pulse (EMP) attacks, or threaten low-Earth orbiting satellites in space.

The testing of higher yield nuclear weapons gives North Korea the ability to attack electrical and electronic systems over a wide area. Detonating a nuclear weapon at high altitude, such as in low-Earth orbit (LEO), would generate EMP, which would fry electrical and electronic circuits over a large geographic area.

EMP isn’t new; we’ve known about it since the Cold War, as a result of high-altitude nuclear testing such as the ‘Starfish Prime’ test in 1962. The effects of that test on terrestrial electrical systems generated concerns that the Soviet Union could blanket the US or NATO with sufficient EMP to burn out critical command and control networks and disrupt Washington’s nuclear retaliatory capability in the opening stages of a nuclear first strike. Such an attack would have had an even more devastating effect on non-hardened civilian infrastructure.

Earlier this year, North Korea’s testing of ICBMs included trajectories lofted to very high altitudes, which allowed Pyongyang to test warhead re-entry survivability, and minimised the risk of US military retaliation. The tests also demonstrated North Korea’s ability to detonate a nuclear weapon at high altitudes to generate EMP. Carrying out such an attack wouldn’t require accurate guidance, or high-yield warheads that are capable of surviving the heat of atmospheric re-entry, or even ICBMs.

A 2008 EMP Commission report (PDF) found that **exo**-**atmospheric** **detonations** of nuclear weapons would directly **affect** critical civilian **infrastructure**, most notably for power generation, telecommunications and data networks, as well as robotic industrial and manufacturing infrastructure. Analysis in June of this year on 38 North suggests that North Korea is already well placed to cause substantial damage to unprotected civilian networks using such attacks. That would hold true against the US, as well as its allies such as Japan and South Korea, or even Australia.

Evidence given by Peter Vincent Pry to the 2004 EMP Commission suggested that (PDF, p. 5) North Korea, with Russian assistance, was developing a ‘super-EMP’ weapon designed to affect a broad range of electronic systems. Such a weapon could be delivered by a missile, or it could be deployed in a satellite in a manner similar to the Soviet-era Fractional Orbital Bombardment System (FOBS).

If North Korea could detonate a nuclear weapon in space, it could also undertake a ‘**Van** **Allen’** attack that would be designed to excite and **expand** the lower Van Allen **radiation** **belt** around Earth, exposing up to 803 satellites in LEO to high levels of radiation. US Defense Threat Reduction Agency analysis in 2010 suggested that satellites in LEO, which are not hardened against radiation found in higher orbits, would be vulnerable to nuclear detonations that ‘**pumped’** the intensity of the Van Allen belts. Weeks or months of cumulative damage generated by passing through the zones of radiation would **cause** those **satellites** **to** **fail**. A Van Allen attack is highly indiscriminate: any satellite passing through the excited lower belt would be damaged. US satellites would be just as defenceless as those belonging to China, Russia or other states.

Certainly satellites could be replaced, but it would take years to completely restore the lost capability. The requirement to wait until Van Allen belts returned to normal levels of radiation, limited launch capability, long production queues, and the high cost for new satellites would slow the process down. If a combined Van Allen and EMP attack was effectively carried out, the ability to re-establish space systems could be at risk if satellite production facilities were damaged. In the interim, global economic systems would fall apart as the vital communications links for stock markets collapsed.

The Trump administration is maintaining that ‘all options are on the table’ for dealing with North Korea’s growing nuclear threat. The prospects for war on the peninsula are bad enough, with massed North Korean artillery attacks on Seoul a leading concern as well as the prospect of a general North Korean offensive into South Korea. The risk of a war escalating across the nuclear threshold raises the spectre of the first use of nuclear weapons in anger since Nagasaki—against South Korea, Japan or US territory—and the possibility that **Pyongyang** could **devastate** its **opponents’** economies with EMP and destroy vital space infrastructure with Van Allen attacks. In any war, North Korea would certainly face defeat and, with it, the end of Kim Jong-un’s regime. In confronting his fate, Kim Jong-un would have everything to gain and little to lose by employing such a devastating tactic.

#### Van Allen causes extinction.

Karl **Grossman 96**, professor of journalism at the State University of New York/College of New York, ’96, "Risking the World: Nuclear Proliferation in Space," Covert Action Quarterly, Summer 1996

To say nothing of the Earth and the life on it if something goes wrong. Plutonium has long been described by scientists as the **most toxic substance known**. It is "so toxic," says Dr. Helen Caldicott, founder of Physicians for Social Responsibility, "that less than one millionth of a gram is a carcinogenic dose. One pound, if uniformly distributed, could hypothetically induce **lung cancer in every person on Earth**." (3)

In addition to the specter of radioactivity spread by an accident on launch, another, potentially more lethal, scenario is causing concern. Because Cassini does not have the propulsion power to get directly from Earth to Saturn, NASA plans a "slingshot maneuver" in which the probe will circle Venus twice and hurtle back at Earth. It will then buzz the Earth in August 1999 at 42,300 miles per hour just 312 miles above the surface. After whipping around Earth and using its gravity, Cassini would then have the velocity, says NASA, to reach Saturn. But during that Earth fly-by, if Cassini comes in too close, it could burn up in the 75 mile-high atmosphere and disperse plutonium across the planet.

Dr. Michio Kaku, professor of nuclear physics at the City University of New York, explains the catastrophic consequence of such a fly-by accident:

"[If] there is a small misfire [of Cassini's] rocket system, it will mean that [it] will penetrate into the Earth's atmosphere and the sheer friction will begin to wipe out the heat shield and it will, like a meteor, **flame into the Earth's atmosphere** ... This thing, coming into the Earth's atmosphere will vaporize, release the payload and then particles of plutonium dioxide will begin to **rain down on populated areas**, if that is where the system is going to be hitting. [Pulverized plutonium dust] will rain down on people's hair, people's clothing, get into people's bodies. And because it is not water soluble, there is a very good chance that it could be inhaled and stay within the body causing cancer over a number of decades." (4)

Indeed, NASA says in its Final Environmental Impact Statement for the Cassini Mission, that if an "inadvertent reentry occurred" during the fly-by, approximately five billion of the seven to eight billion people on Earth, "could receive 99 percent or more of the radiation exposure." (5) As for the death toll, which NASA labels "health effects," the agency says that only 2,300 deaths "could occur over a 50-year period to this exposed population" and these "latent cancer fatalities" would likely be "statistically indistinguishable from normally occurring cancer fatalities among the world population." (6)

However, after reviewing the data in the NASA report, Dr. Ernest Sternglass, professor emeritus of radiological physics at the University of Pittsburgh School of Medicine, concluded that NASA "underestimate[s] the cancer alone by about 2,000 to 4,000 times. Which means that not counting all the other causes of death--infant mortality, heart disease, immune deficiency diseases and all that--we're talking in the order of ten to twenty million extra deaths." The actual death toll, then, the physicist warned, may be as high as 30 to 40 million people. (7)

**Conflict spills over to cascading debris and decks access---especially with missile development.**

**Skibba 20** (, R., 2020. The Ripple Effects of a Space Skirmish. [online] The Atlantic. Available at: <https://www.theatlantic.com/technology/archive/2020/07/space-warfare-unregulated/614059/> [Accessed 12 January 2022] Ramin Skibba is a San Diego-based astrophysicist turned science writer. His work has appeared in Undark magazine, New Scientist, and Nature.)-rahulpenu

The **Ripple** **Effects** of a Space Skirmish

If a conflict breaks out between countries with weapons in orbit, it could **threaten** space **access** for everyone.

On April 22, after several failed attempts, Iran’s Islamic Revolutionary Guard Corps announced a successful launch of what it described as a military reconnaissance satellite. That satellite joined a growing list of weapons and military systems in orbit, including those from Russia (which in April tested a missile program designed to destroy satellites) and India (which launched an anti-satellite weapon in March 2019).

Experts like Brian Weeden, director of program planning at the Secure World Foundation (SWF), a nonpartisan think tank based in Broomfield, Colorado, worry that these developments—all confirmed by the newly rebranded United States Space Force—threaten to lift earthly conflicts to new heights and put all space activities, peaceful and military alike, at risk. Researchers at SWF and at the Center for Strategic and International Studies (CSIS), a nonpartisan think tank in Washington, D.C., both released reports this year on the rapidly evolving state of affairs. The reports suggest that the biggest players in space have upgraded their military abilities, including satellite-destroying weapons and technologies that disrupt spacecraft, by, for instance, blocking data collection or transmission.

Many of these technologies, if deployed, could ratchet up an **arms** **race** and even spark a skirmish in space, the SWF and CSIS researchers caution. Blowing up a single satellite scatters debris throughout the atmosphere, said Weeden, co-editor of the SWF report. Such an explosion could hurl projectiles in the paths of other spacecraft and threaten the accessibility of space for everyone.

“Those are absolutely the two best reports to be looking at to get a sense of what’s going on in the space community,” said David Burbach, a national security affairs expert at the U.S. Naval War College in Newport, Rhode Island, who was not involved in the new research.

Today, Burbach added, the world is very different compared with the Cold War era, when access to space was essentially limited to the United States and the Soviet Union. Many more countries now have space programs, including India, Iran, North Korea, France, Japan, and Israel.

Despite this expansion—and the array of new space weapons—relevant policies and regulatory bodies have remained stagnant. “What worries us in the international community is that there aren’t necessarily any guardrails for how people are going to start interfering with others’ space systems,” said Daniel Porras, a space security fellow at the United Nations Institute for Disarmament Research in Geneva. “There are **no** **rules** **of** **engagement**.”

The new reports use available evidence and intelligence to explore a range of weapons that various countries’ militaries are developing or testing—or already have operational. (Notably, CSIS’s report doesn’t include the American military.) Each nation has unique abilities and characteristics. For example, India has invested heavily in space infrastructure and capabilities, while Japan’s post–World War II space activities were limited until a recent change to its constitution. For Israel’s space program, Weeden said, little good data is available.

Potential missile attacks on military satellites “tend to get most of the attention, but that is not all that we see happening around the world,” said Todd Harrison, director of the Aerospace Security Project at CSIS and a principal author of its report, during an April 6 livestream.

For example, the thousands of everyday satellites that already circle **low**-**Earth** **orbit**, below an altitude of 1,200 miles, could potentially **suffer** **collateral** **damage**. More than half of those satellites are from the U.S.; many of the rest are from China and Russia. They provide key services like internet access, GPS signals, long-distance communications, and weather information. Any missile that smashes into a satellite—either as an attack or during a test—would disperse thousands of bits of debris. Any one of those pieces, still hurtling at orbital speeds, could take out another spacecraft and create yet more debris.

“It’s **very** **easy** **to** **pollute** space,” Burbach said. “The debris doesn’t discriminate. If you create debris, it might just as well come back and hit one of your own satellites. So I think we’re pretty unlikely to see countries actually use those capabilities.” Still, he said, “it would be worrying to see countries showing off that [they] can do it and start testing.”

When China conducted an anti-satellite missile test in 2007, it created a massive cloud of space junk that drew international condemnation. India’s engineers tried to limit debris from their recent test by conducting it at a low altitude, so that Earth’s gravity would pull the pieces down and they would burn up on descent. But some pieces were flung up to the International Space Station’s orbit. There were no collisions; as of February, only 15 trackable pieces of debris remained in orbit, said Victoria Samson, director of the Secure World Foundation’s Washington office, during the CSIS livestream in April.

A number of countries are developing new military technologies for space. France, for instance, is working on laser beams that could dazzle another country’s satellite, preventing it from taking pictures of classified targets. North Korea is studying how to jam radio frequency signals sent to or from a satellite, and Iran is devising cyberattacks that could interfere with satellite systems. Meanwhile, the big three space heavyweights—the U.S., Russia, and China—are already capable of all three approaches, according to the SWF report.

The big three have also begun to master what the reports call “rendezvous and proximity operations,” which involve using satellites as surveillance devices or weapons. A satellite could maneuver within miles of a rival’s classified satellite, snap photos of equipment, and transmit the pictures down to Earth. Or a satellite could sidle up to another and spray its counterpart’s lenses or cover its solar panels, cutting off power and rendering it useless. Russia may be ahead with this technology, having already launched a series of small “inspector satellites,” as the Russian government calls them. Last fall, according to Gen. John “Jay” Raymond, chief of space operations for the U.S. Space Force, one crept near a U.S. spy satellite, which he called a “potentially threatening behavior.”

So far, there are relatively few international policies or norms about what’s allowed in modern-day space and what’s not. The SWF report notes that an incident or misunderstanding could escalate tensions if it’s perceived as an attack.

The lack of guidance has left room for a range of activities. Weeden said that in December 2019, the Trump administration signaled its intention to strengthen the United States’ space weaponry and protect its spacecraft from possible attacks by Russia and China by transforming the Air Force Space Command into the U.S. Space Force. That shift “brought a full-time operational focus to the space domain, which was a needed change,” wrote Lieutenant Colonel Christina Hoggatt, a Space Force spokesperson, in a statement to Undark. With these forces, the Defense Department seeks to “strengthen deterrence” and improve capabilities to “defend our vital assets in space,” she wrote. This emphasis, Burbach said, likely means that the U.S. military will focus on making satellites more resilient to attack, rather than developing offensive weapons.

David A. Graham: Why the Space Force is just like Trump University

Compared with the U.S., smaller space powers have fewer satellites and therefore less to lose, the U.N.’s Porras said. He argues that tense **regional** **relationships** could be particularly **unpredictable**. For example, he said, if North Korean leaders found themselves in a standoff with South Korea and the U.S., they might launch and detonate a nuclear weapon in space; its **dangerous** **radiation** would **disable** most **satellites**.

The U.N. and other international groups—including SWF and the Outer Space Institute, a global research organization based in British Columbia—are working to avoid such scenarios. Weeden said that as long as countries don’t launch destructive space weapons near other countries’ spacecraft, conduct overtly provocative tests, or disable critical satellites, peaceful space activities should continue. For now, he points out, countries have only tested missiles on their own defunct satellites, and exercises against other nations’ spacecraft have remained nondestructive.

Existing international laws offer little guidance for modern military technology in space. While these rules—including the Partial Nuclear Test Ban Treaty of 1963 and the U.N.’s Outer Space Treaty of 1967—prohibit weapons of mass destruction in space, they don’t explicitly limit other kinds of space weapons, tests, or military space forces.

Weeden points out that space diplomats could create new guidelines by developing something like the Incidents at Sea agreement, which the U.S. and the Soviet Union signed during the Cold War to maintain safe distances between ships and avoid maneuvers in heavy traffic. But until similar rules involving space weaponry are hammered out, he said, unexpected satellite tests will inevitably fuel speculation and paranoia.

“Any time you have militaries operating near each other without a lot of transparency or clarity,” he added, “you always have the opportunity for misperceptions that could lead to something very bad.”

#### Independently causes extinction.

George Dvorsky 15. Senior Staff reporter at Gizmodo. "What Would Happen If All Our Satellites Were Suddenly Destroyed?" <https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681>.

Lastly, there’s the [Kessler Syndrome](http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/) to consider. This scenario was portrayed in the 2013 film Gravity. In the movie, a Russian missile strike on a defunct satellite inadvertently causes a cascading chain reaction that formed an ever-growing cloud of orbiting space debris. Anything in the cloud’s wake — including satellites, space stations, and astronauts — gets annihilated. Disturbingly, the Kessler Syndrome is a very real possibility, and the likelihood of it happening [is steadily increasing as more stuff gets thrown into space](http://io9.com/how-to-clean-up-deadly-space-junk-before-disaster-strik-1443463338). Given these grim prospects, it’s fair to ask what might happen to our civilization if any of these things happened. At the risk of gross understatement, the complete loss of our satellite fleet would instigate a tremendous disruption to our current mode of technological existence — disruptions that would be experienced in the short, medium, and long term, and across multiple [domains](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681). Compromised Communications Almost immediately we’d notice a dramatic reduction in our ability to communicate, share information, and conduct transactions. “If our communications satellites are lost, then bandwidth is also lost,” [Jonathan McDowell](http://planet4589.org/) tells io9. He’s an astrophysicists and Chandra Observatory scientist who works out of the [Harvard-Smithsonian Center for Astrophysics](http://planet4589.org/jcm/cfa-www.harvard.edu). McDowell says that, with telecommunication satellites wiped out, the burden of telecommunications would fall upon undersea cables and ground-based communication systems. But while many forms of communication would disappear in an [instant](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681), others would remain. All international calls and data traffic would have to be re-routed, placing tremendous pressure on terrestrial and undersea lines. Oversaturation would stretch the capacity of these systems to the limit, preventing many calls from going through. Hundreds of millions of Internet connections would vanish, or be severely overloaded. A similar number of cell phones would be rendered useless. In remote areas, people dependent on satellite for television, Internet, and radio would practically lose all service. “Indeed, a lot of television would suddenly disappear,” says McDowell. “A sizable portion of TV comes from cable whose companies relay programming from satellites to their hubs.” It’s important to note that we actually have a precedent for a dramatic — albeit brief — disruption in com-sat capability. Back in 1998, [there was a day in which a single satellite failed and all the world’s pagers stopped working](http://articles.latimes.com/1998/may/21/news/mn-52190). Get Out Your Paper Maps We would also lose the Global Positioning System. In the years since its inception, GPS has become ubiquitous, and a surprising number of systems have become reliant on it. “Apart from the fact that everyone has forgotten to navigate without GPS in their cars, many airplanes use GPS as well,” says McDowell. Though backup systems exist, airlines use GPS to chart the most fuel-efficient and expeditious routes. Without GPS and telecomm-sats, aircraft controllers would have tremendous difficulty communicating with and routing airplanes. Airlines would have to fall back to legacy systems and procedures. Given the sheer volume of airline traffic today, accidents would be all but guaranteed. Other affected navigation systems would include those aboard cargo vessels, supply-chain management systems, and transportation hubs driven by GPS. But GPS does more than just provide positioning — it also provides for timing. Ground-based atomic clocks can perform the same function, but GPS is increasingly being used to distribute the universal time standard via satellites. Within hours of a terminated service, any distributing networks requiring tight synchronization would start to suffer from “clock drift,” leading to serious performance issues and outright service outages. Such disruptions could affect everything from the power grid through to the financial sector. In the report, “[A Day Without Space: Economic and National Security Ramifications](http://marshall.org/wp-content/uploads/2013/08/Day-without-Space-Oct-16-2008.pdf),” Ed Morris, the Executive Director of the Office of Space Commerce at the Department of Commerce, writes: If you think it is hard to get work done when your internet connection goes out at the office, imagine losing that plus your cell [phone](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681), TV, radio, ATM access, [credit cards](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681), and possibly even your electricity. [...] Wireless services, especially those built to [CDMA standard](http://www.protocols.com/pbook/cellular.htm), would fail to hand off calls from one cell to the next, leading to dropped connections. Computer networks would experience slowdowns as data is pushed through finite pipelines at reduced bit rates. The same would be true for major networks for communication and entertainment, since they are all IP-based today and require ultra-precise timing to ensure digital traffic reaches its destination. The lack of effective synch would hit especially hard in banking, where the timing of transactions needs to be recorded. Credit card payments and bank accounts would likely freeze, as billions of dollars could be sucked away from businesses. A financial crash is not out of the question. The Loss of Military Capability The sudden loss of satellite capability would have a profound effect on the military. The Marshall Institute puts it this way: “Space is a critical enabler to all U.S. warfare domains,” including intelligence, navigation, communications, weather prediction, and warfare. McDowell describes satellite capability as as the “backbone” of the U.S. military. And as 21st century warfare expert [Peter W. Singer](http://www.pwsinger.com/biography.html) from [New America Foundation](https://www.newamerica.org/) tells io9, “He who controls the heavens will control what happens in the battles of Earth.” Singer summarized the military consequences of losing satellites in an email to us: Today there are some 1,100 active satellites which act as the nervous system of not just our economy, but also our military. Everything from communications to GPS to intelligence all depend on it. Potential foes have noticed, which is why Russia and China have recently begun testing a new generation of anti-satellite weapons, which in turn has sparked the U.S. military to recently budget $5 billion for various space warfare systems. What would happen if we lost access to space? Well, the battles would, as one U.S. military officer put it, take us back to the “pre digital age.” Our drones, our missiles, even our ground units wouldn’t be able to operate the way we plan. It would force a rewrite of all our assumptions of 21st century high tech war. We might have a new generation of stealthy battleships...but the loss of space would mean naval battles would in many ways be like the game of Battleship, where the two sides would struggle to even find each other. Moreover, and as McDowell explains to io9, the loss of satellite capability would have a profound effect on arms control capabilities. Space systems can monitor compliance; without them, we’d be running blind. “The overarching consideration is that you wouldn’t really know what’s going on,” says McDowell. “Satellites provide for both global and local views of what’s happening. We would be less connected, less informed — and with considerably degraded situational awareness.” Compromised Weather Prediction and Climate Science One great thing satellites have done for us is improve our ability to forecast weather. Predicting a slight chance of cloudiness is all well and good, but some areas, like India, Pakistan, and Bangladesh, are dependent on such systems to predict potentially hazardous monsoons. And in the U.S., the NOAA has estimated that, during a typical hurricane season, weather satellites save as much as $3 billion in lives and property damage. There’s also the effect on science to consider. Much of what we know about climate change comes from satellites. As McDowell explains, the first couple of weeks without satellites wouldn’t make much of a difference. But over a ten-year span, the lack of satellites would preclude our ability to understand and monitor such things as the ozone layer, carbon dioxide levels, and the distribution of polar ice. Ground-based and balloon-driven systems would help, but much of the data we’re currently tracking would suddenly become much spottier. “We’re quite dependent on satellites for a global view of what’s happening on our planet — and at a time when we really, really need to know what’s happening,” says McDowell. It’s also worth pointing out that, without satellites, we also wouldn’t be able to monitor space weather, such as incoming space storms. Time to Recover With all the satellites gone, both governmental and private interests would work feverishly to restore space-based capabilities. Depending on the nature of the satellite-destroying event, it could take decades or more to get ourselves back to current operational standards. It would take a particularly long time to recover from a Carrington Event, which would zap many ground-based electronic systems as well. The U.S. military is already thinking along these lines, which is why it’s working on the ability to quickly send up emergency assets, such as small satellites parked in Low Earth Orbit (LEO). Cube satellites are increasingly favored, as an easy-to-launch, affordable, and effective solution — albeit a short-term one. The U.S. Operationally Responsive State Office is currently working on the concept of emergency replenishment and the ability to “rapidly deploy capabilities that are good enough to satisfy warfighter needs across the entire spectrum of operations, from peacetime through conflict.” As for getting full-sized, geostationary satellites back into orbit, that would prove to be a greater challenge. It can take years to built a new satellite, which typically requires a big, costly rocket to get it into space. Lastly, if a Kessler Syndrome wipes out the satellites, that would present an entirely different recovery scenario. According to McDowell, it would take a minimum of 11 years for LEO to clear itself of the debris cloud; any objects below 500 km (310 miles) would eventually fall back to Earth. Thus, we would only be able to start re-seeding LEO in a little over a decade following a Kessler event. Unfortunately, the area above 600 km (372 miles) would remain out of touch for a practically indefinite period of time; objects orbiting at that height tend to stay there for a long, long time. We’d probably lose this band for good — unless we manually removed the debris field, using clean-up satellites or other techniques. It’s worth noting that a single Kessler event could hit the LEO zone or the GEO zone (geosynchronous orbit) but realistically not both; LEO debris could never reach GEO, and vice versa — though a spent rocket in GTO (geosynchronous transfer orbit) or SSTO (supersynchronous transfer orbit) passes through or near both zones and could potentially affect either of them. The spent rockets in GTO do not stay too close to the GEO arc for long due to orbital perturbations, so a GEO Kessler event is very unlikely to be triggered by one of them. Suffice to say, we should probably take the prospect of a Kessler Syndrome more seriously, and be aware of what could happen if we’re no longer able to use these spaces.

#### Noko uses even more capabilities on the US---ensures escalation.

Harrison et al. 18 (, T., Johnson, K. and Roberts, T., 2018. A REPORT OF THE CSIS AEROSPACE SECURITY PROJECT. [online] Aerospace.csis.org. Available at: <https://aerospace.csis.org/wp-content/uploads/2018/04/Harrison\_SpaceThreatAssessment\_FULL\_WEB.pdf> [Accessed 13 January 2022] Todd Harrison is the director of Defense Budget Analysis and director of the Aerospace Security Project at CSIS. As a senior fellow in the International Security Program, he leads the Center’s efforts to provide in-depth, nonpartisan research and analysis of defense funding, space security, and air power issues. He has authored publications on trends in the defense budget, military space systems, threats to space systems, civil space exploration, defense acquisitions, military compensation and readiness, and military force structure, among other topics. He teaches classes on military space systems and the defense budget at the Johns Hopkins School of Advanced International Studies. Kaitlyn Johnson is deputy director and fellow of the Aerospace Security Project at the Center for Strategic and International Studies. Ms. Johnson supports the team’s strategic planning and research agenda. Her research specializes in topics such as space security, military space systems, and commercial and civil space policy. Ms. Johnson has written on national security space reorganization, threats against space assets, the commercialization of space, escalation and deterrence dynamics, and defense acquisition trends. She is also a cohost of the CSIS podcast Tech Unmanned, which features guests with both policy expertise and technical expertise in order to break through the national security jargon and technology hand-waving to get to the core of the technical realities of these emerging capabilities, benefits to development, and the barriers to success. Ms. Johnson holds an MA from American University in U.S. foreign policy and national security studies, with a concentration in defense and space security, and a BS from the Georgia Institute of Technology in international affairs. Thomas G. Roberts is an adjunct fellow with the Aerospace Security Project at the Center for Strategic and International Studies. His research interests include civil and commercial space policy, space security, and orbital mechanics. Previously, Mr. Roberts has written on threats against space systems, space object behavior, and international relations in space. His work has appeared in The Atlantic, the Bulletin of the Atomic Scientists, War on the Rocks, and other publications. Mr. Roberts is currently a graduate research fellow at the Massachusetts Institute of Technology’s (MIT) Astrodynamics, Space Robotics, and Controls Laboratory and a PhD student in the institute’s Department of Aeronautics and Astronautics. He holds an MS in aeronautics and astronautics and an MS in technology and policy from MIT and a BA in astrophysical sciences from Princeton University. In 2015, Mr. Roberts was named a Harry S. Truman scholar. In 2021, he was awarded the National Science Foundation’s Graduate Research Fellowship in support of his doctoral research in computational astrodynamics at MIT.)-rahulpenu

NORTH KOREA

North Korea is a critical threat to the United States and our allies in Northeast Asia and is our hardest intelligence collection target.

LTG ROBERT ASHLEY, DIRECTOR, DEFENSE INTELLIGENCE AGENCY160 OVERALL SPACE CAPABILITIES 161

NORTH KOREA HAS AN ACTIVE SPACE PROGRAM that is closely related to its missile program, which has made significant progress in recent years. Still, many experts doubt that the few satellites launched by North Korea perform all of the functions that the North Korean government claims.162 There is little indication that North Korea is making substantial efforts to build or sustain a space industrial base, but its missile program is growing and many believe that it is aided by technology from China, Iran, and/or Pakistan.163 North Korea successfully orbited its first satellite in December 2012 after three failed attempts in July 2006, April 2009, and April 2012. The successful launch used the Unha-3, a launch vehicle believed to be a variant of the Taepodong-2 ICBM. In its fifth test in February 2016, it successfully placed a second satellite in orbit.164 While the space capabilities provided by these two satellites have little if any military significance, it demonstrates that the nation has the capability of placing an object into orbit. Moreover, North Korea has publicly stated its intent to continue launching remote sensing satellites and to send an unmanned mission to the moon within a decade.165

In parallel with its space program, North Korea has also made significant progress in developing and testing ballistic missiles. Under the Kim JongUn regime, it has ramped up its missile test program from 6 ballistic missile launches in 2012 to 25 launches in 2017.166 Its November 2017 test of the Hwasong-15 ICBM followed a lofted trajectory to reach an apogee of 4,475 km and a range of 950 km. If the same vehicle with the same payload were launched on a range-maximizing trajectory, it could reach virtually any location in the United States.167 Based on publicly available information, however, it is not clear whether North Korea has developed the re-entry vehicle technology that would be necessary to deploy a conventional or nuclear warhead on its long-range missiles.

SPACE ORGANIZATION AND DOCTRINE LITTLE IS KNOWN ABOUT NORTH KOREA’S DOCTRINE or operational concepts for the use of space and counterspace capabilities. Most of the country’s military capabilities appear to be focused on ensuring the survival of the regime and deterring foreign aggression, and it maintains “a stridently confrontational posture against the United States.”168 When the regime speaks publicly about space, it is usually in the context of peaceful programs and its right to be a space power. It has been noted that the absence of discussion about counterspace capabilities that could threaten the U.S. military is curious given the aggressive rhetoric used by the regime in touting its nuclear and missile programs.169

COUNTERSPACE WEAPONS Kinetic Physical To date North Korea has not tested, or indicated that it is attempting to develop, a direct-ascent or co-orbital ASAT capability. The space launch and ballistic missile technology demonstrated by North Korea could serve as the basis for a kinetic ASAT capability, but many technological hurdles remain. An effective directascent or co-orbital ASAT weapon would require various onboard sensors—optical, infrared, radar, etc.—and a guidance system to steer the warhead into a target satellite. There are no indications that North Korea has or is attempting to acquire the technology needed for this.170 Like Iran, it is conceivable that North Korea could field a crude direct-ascent ASAT capability in the near-term by adapting a ballistic missile to launch an unguided warhead to detonate in the vicinity of a target satellite. Such a weapon would be unlikely to directly strike a satellite, but could create a debris field that complicates future operations for the target satellite and any other satellites in a similar orbit.

Non-Kinetic Physical

There is some evidence that North Korea may be developing or has already acquired non-kinetic physical counterspace weapons such as a nuclear EMP device.171 However, the technology necessary for more sophisticated directed-energy weapons, such as lasers that can dazzle or blind the sensors on satellites, requires a level of technology that North Korea is unlikely to possess anytime soon.172 Another country, particularly China or Russia, could provide such capabilities to North Korea, but there is no publicly available evidence to suggest this has occurred. Given its existing ballistic missile and nuclear capabilities, North Korea could theoretically launch a nuclear weapon into space and detonate it.173 Using a nuclear weapon in this manner does not require re-entry vehicle technology like a nuclear-armed ICBM would. Tests of nuclear weapons in space were banned by the 1963 Partial Test Ban Treaty, but North Korea is not a signatory to this treaty.174 In a written statement to Congress in 2017, the Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack (the EMP Commission) offered evidence that North Korea may be developing an EMP weapon. The EMP Commission notes that in 2004 two Russian generals warned the commission that the design for a Russian EMP warhead was unintentionally transferred to North Korea. South Korean intelligence officials told the press in 2009 that Russian scientists were in North Korea helping to develop an EMP weapon. Moreover, the commission notes that in 2013 a Chinese military commentator indicated that North Korea already has “Super-EMP nuclear weapons.”175

Electronic North Korea has acquired and is actively using electronic forms of attack against U.S. space systems. In 2010, the South Korean Defense Minister, Kim Tae-young, said in a speech to parliament that “North Korea has imported vehicle-mountable devices capable of jamming GPS signals from Russia.”176 These downlink jamming systems reportedly have an effective radius of 50 to 100 km. North Korea began using this jamming equipment against South Korea in August 2010, but South Korean forces could not pinpoint the location of the jammers at that time because the jamming lasted just 10 minutes in each instance.177 In the years since, North Korea has repeatedly used its GPS jamming capabilities against South Korea. More GPS jamming occurred in December 2010 and again in March 2011. The 2011 incident lasted 10 days and coincided with an annual U.S.-Korean military exercise.178 Jamming occurred again in April 2012, disrupting air traffic at Incheon and Gimpo International Airports, and forcing flights to use alternative navigation systems.179 In 2016, South Korea complained to the United Nations Security Council that the North was again jamming GPS signals across the border, with the jamming coming from five areas in North Korea: Pyongyang, Kaesong, Haeju, Yonan county, and Mount Kumgang.180 The South Korean Defense Ministry has said it believes the jamming attacks originate from “a regiment-sized electronic warfare unit near the North Korean capital Pyongyang, and battalion-sized units closer to the inter-Korean border.”181 The jammers are mounted on mobile platforms and are operated intermittently, and they could be difficult to locate and neutralize in a conflict. North Korea appears to be gaining operational experience using these systems in peacetime. To what extent these capabilities are integrated into its overall military operations remains unknown. Since the GPS jammers were acquired from Russia, it is possible that North Korea could also have acquired other types of jamming capabilities that can target different satellite systems, such as uplink jammers that can disrupt military satellite communications. Despite South Korean protests to the United Nations that the North’s GPS jamming is a violation of the 1953 armistice agreement,182 no effective measures have been undertaken to date to curb this activity.

NORTH KOREA HAS ACQUIRED AND IS ACTIVELY USING ELECTRONIC FORMS OF ATTACK AGAINST U.S. SPACE SYSTEMS.

Cyber

General Vincent Brooks, commander of United States Forces Korea, noted in congressional testimony that North Korea’s well-organized and advanced cyber forces are perhaps among the best in the world.183 Under the Kim Jong-Un regime, North Korea has exercised these cyber forces frequently, launching attacks on South Korea, the United States, and others. In one of the most widely reported incidents, North Korea launched a cyberattack against Sony Pictures Entertainment in November 2014.184 The following month, in a move that may have been intended to demonstrate the capability to damage physical infrastructure through cyberspace, North Korea conducted a cyberattack on a South Korean nuclear power plant.185 Given its demonstrated cyber capabilities, it is conceivable that North Korea could initiate a cyberattack against U.S. space systems to intercept information, as it did in the Sony attack, or to inject corrupt information that could cause physical damage to U.S. satellites or the forces that depend on them.

#### Pursing missile capabilities decks interoperability and the alliance---steals the teeth of the US deterrence strategy---mature tech necessitates the shift.

Pollack 17 (, J., 2017. Ballistic Missile Defense in South Korea: Separate Systems Against a Common Threat. [online] Cissm.umd.edu. Available at: <https://cissm.umd.edu/sites/default/files/2019-07/Paper%204%20-%20Ballistic%20Missile%20Defense%20in%20South%20Korea.pdf> [Accessed 13 January 2022] Joshua H. Pollack is the Editor of the Nonproliferation Review and a Senior Research Associate, and is recognized as a leading expert on nuclear and missile proliferation, focusing on Northeast Asia. Before joining MIIS in April 2016, Pollack served as a consultant to the US government, specializing in issues related to weapons of mass destruction, including proliferation, arms control, and deterrence. As a defense policy analyst at DFI International, Science Applications International Corporation, and Constellation West, his clients included the Defense Threat Reduction Agency, the Office of the Under Secretary of Defense for Policy, the Department of Homeland Security, the National Nuclear Security Administration, and the Plans and Policy Directorate (J5) of US Strategic Command. In 2015, he was named an Associate Fellow of the Royal United Services Institute.)-rahulpenu

Executive Summary

Some of the most **enduring** **disagreements** **in** the **alliance** between the United States and the Republic of Korea (ROK) concern ballistic missile defenses (BMD). At the same time that South Korea has expanded its conventional **offensive** **missile** **program**, it has **declined** American proposals for a regionally integrated BMD architecture, insisting on developing its own national system in parallel to the defenses operated by U.S. Forces Korea (USFK). American appeals for interoperability between U.S. and ROK systems have been received cautiously, as were proposals to enhance its own BMD in Korea by introducing the Terminal HighAltitude Area Defense (THAAD) to the Peninsula for several years. A desire for expanded **autonomy** in national security appears to **underpin** Seoul’s **attitudes** on BMD. Rather than rely passively on American protection against North Korea’s nuclear and missile threats, South Korea’s military leaders have focused on developing precision-strike capabilities to intimidate Pyongyang, and resisted simply accepting an American BMD umbrella. Even more than they desire greater independence from their American patron-ally, South Koreans are suspicious of entanglements with Japan, their former colonial master, whose own defensive systems are already integrated with the American regional BMD architecture. This outlook encourages the pursuit of independent defense capabilities and **discourages** **institutionalizing** trilateral **security** **arrangements**.

Introduction

South Korea (the Republic of Korea, or ROK) has the unusual distinction of hosting two unrelated ballistic missile defense (BMD) systems: one for the South Korean military and another for U.S. Forces Korea (USFK). Despite the standing presence of over 25,000 American troops, yoked to South Korea’s armed forces in a Combined Forces Command (CFC); despite routine joint training and exercises between the two allies; and despite almost two decades of urgings from the United States to build an integrated BMD architecture, the two systems have remained separate. Even while Washington negotiated with Seoul for permission to enhance USFK’s defenses by deploying the Terminal High-Altitude Area Defense (THAAD) system to the Peninsula, South **Korea** has remained committed to its own national Korean Air and Missile Defense (KAMD) system, based on a variety of technologies from different sources, including indigenously produced interceptors. Years of pledges by South Korean defense officials have produced little observable progress toward making the separate American and Korean systems interoperable, despite benefits for the effectiveness of allied BMD in the theater.

South Korea’s approach to BMD is thus at a great remove from America’s experience with other allies. The European Phased Adaptive Approach (EPAA), adopted early in the Obama administration, has been portrayed as a model for other regional architectures, but **South** **Korea’s** **choices** have allowed for only **halting** **progress** **toward** regional **integration**.1 While the missile threat from North Korea (the Democratic People’s Republic of Korea, or DPRK) justifies and motivates South Korea’s interest in BMD capabilities, it has not, by itself, determined the ROK’s approach. Instead, concerns unrelated to the operational effectiveness of any particular BMD architecture have shaped these choices.

South Korean BMD Concerns

The first and greatest issue has been cost relative to perceived benefit; very simply, the South Korean defense establishment has preferred to invest in offensive missile capabilities to intimidate North Korea with the threat of precision strikes. Not far behind is national pride, in the form of **South** **Korea’s** **desire** for greater **independence** from its patron-ally, the United States, and its resistance to entanglements with its former colonial master, Japan. Other considerations have included sensitivity to the concerns of China, which is South Korea’s top trading partner and main opportunity for leverage on North Korean behavior, and perhaps also the interests of South Korea’s own defense industries.

Many of these issues and concerns have found their most visible expression in areas not immediately or uniquely linked to BMD. Korea has never truly been able to determine its own fate in the modern era; security issues therefore tend to impinge strongly on Korean national pride. One prominent example in the period discussed in this paper is the premature decision for the transfer of wartime operational control of the armed forces (OPCON) by 2012, initially agreed between the Minister of National Defense and the U.S. Secretary of Defense in fall 2006.2 After North Korea’s armed attacks against South Korea in 2010, the allies began to reconsider the original timeline for OPCON transfer, and then substituted a “conditions-based” process without fixed dates. Nevertheless, the retention of the commitment to OPCON transfer by two subsequent pro-American governments in Seoul testifies to the power of national feelings in South Korea.3 These same feelings have informed repeated decisions to resist the adoption of a common, integrated BMD architecture.

Another aspect of Korean nationalism, in the form of anti-Japanese sentiment, also helps to explain Seoul’s desire for a separate BMD system. The American BMD architecture in the AsiaPacific region is integrated with Japan’s; this is the system that Washington would like to see Seoul join. Even the mutually beneficial decision to share sensor data between the ROK the United States could therefore contribute indirectly to the defense of Japan, Korea’s former colonial master, whose intentions many Koreans continue to suspect. There are many examples of Korea’s allergy to Japan from the period under consideration; the most salient would be the April 2011 episode, when the Korean side balked at the last moment rather than sign an agreement with Japan to permit the sharing of sensitive defense data (a General Security of Military Information Agreement, or GSOMIA), finally concluded in in the months after North Korea’s fifth nuclear test, despite continued public opposition in South Korea. American efforts to bring about trilateral defense cooperation have had some incremental successes since this time, but the years-long delay in signing the ROK-Japan GSOMIA has been emblematic of the serious obstacles to cooperation.4

A third factor, involving the dominant perspective in China on the significance of BMD deployments, may also have contributed to South Korea’s go-slow approach on acquiring BMD and especially on achieving interoperability with American systems. China is South Korea’s most important trading partner by far; it is also widely viewed as the only country capable of keeping the North Koreans in line. Probably for these reasons, Seoul has at times shown sensitivity to China’s concerns about the American alliance network perched on its doorstep, including the role of BMD. A special concern sometimes reflected in the Chinese media is the tendency of a multinational BMD architecture to embed the U.S. military more deeply in the region.5

A fourth potential concern may be a desire to create greater opportunities for South Korea’s defense industry. In practice, this concern can be difficult to distinguish from nationalistic sentiment; the **belief** **that** **independent** defense **capabilities** are **crucial** **to** the ROK’s **autonomy** goes hand-in-hand with favoring indigenous defense development and production. It is also consistent with South Korea’s long history of industrial policy, including export-oriented industry. The defense sector has not been an exception to this pattern.6

Many of these factors appear to have been in play in the recent debate over the deployment of THAAD. USFK officials have described the need for these high-altitude interceptors in Korea in order to create a “layered defense,” a BMD architecture that permits multiple shots at an incoming warhead. After years of discussion in the media, public opposition from the Chinese Ministry of Foreign Affairs, and a debate in Seoul over whether THAAD in Korea could somehow contribute to the defense of Japan, the United States and South Korea finally agreed to discuss the deployment. Formal talks began soon after North Korea’s fourth nuclear test in January 2016 and its second successful space launch in February 2016.7 An agreement to deploy was announced in July.8

From a U.S. perspective, South Korea’s reticence has created obstacles to the highly collaborative, trilateral defense relationship that the United States has sought to establish between itself, Japan, and South Korea since the late 1990s. The ROK’s insistence on a separate, parallel BMD system features prominently in this story, not least of all because an effective multinational BMD architecture would involve close ties between the allies’ command-andcontrol networks. Reviewing the history of South Korea’s own BMD programs from the mid-1990s to the present shows the enduring strength of these concerns. Despite South Korea’s recent movement toward cautious acceptance of an enhanced U.S. BMD system on its territory, these issues seem unlikely to abate in the foreseeable future.

Early Choices: Low Cost and Self-Reliance

South Korea has faced a threat from hundreds of North Korean theater ballistic missiles since roughly the late 1980s. Seoul’s concern about the threat grew after a series of North Korean ballistic missile flight-tests on May 29, 1993, florid threats from Pyongyang during the nuclear crisis of June 1994, and the start of USFK’s deployment of Patriot batteries to protect its own facilities.9 These events may have contributed to the start of serious discussions within the ROK Ministry of National Defense (MND), no later than fall 1995, about launching a new air and missile defense program. This undertaking was justified in terms of the need to replace South Korea’s aging fleet of U.S.-supplied Nike-Hercules air-defense missiles.10

One path for the acquisition of a BMD system might have been to acquire new, up-to-date systems from a single supplier. Instead, South Korean leaders have persistently sought an independent course, and have resisted the American plans to integrate South Korea for a regional BMD architecture that would emerge later in the decade. Cost concerns were prominent in the information disclosed to the public about the new, so-called “SAM-X” program. Media reports starting in early 1996 indicated that the MND was considering not only Raytheon’s Patriot systems, but also their Russian counterpart, the AlmazAntey S-300. The Russian offering was deemed the leading candidate on the grounds of cost. Russia had borrowed heavily from South Korea in the early 1990s, and found in discounted military exports to Seoul a way to pay down its debt.11 South Korean interest in acquiring Russian systems naturally invited concern from the U.S. military. In May 1998, the USFK commander openly voiced his concern about the need for interoperability of American and South Korean defensive systems.12

American advice, or pressure, seems to have helped to refocus the SAM-X program on Patriot PAC-3 BMD systems, but this shift led to seemingly insuperable cost problems. Although SAMX survived defense budget cuts after the financial crisis of 1997 and the election of opposition leader Kim Dae-jung to the presidency, it was subjected to repeated, years-long delays on account of lack of adequate funding.13 Shortfalls in funding became an enduring theme in South Korean BMD acquisition from this time on, even as the country’s own ballistic and cruise missile programs have prospered.14

North Korea’s launch of a TD-1 multistage rocket over Japan on August 31, 1998 renewed interest in the United States in establishing a National Missile Defense (NMD) and a regional, multinational Theater Missile Defense (TMD) in Northeast Asia, an idea that Japan was quick to embrace.15 The South Korean leadership was reticent about involvement from the start. Even once the MND had accepted the need for a Patriot buy, Minister of National Defense Chun Yong-tack drew a sharp line against participating in the U.S. architecture, questioning its efficacy for deterring North Korea, citing the potential response of other regional countries, i.e., China, and noting South Korea’s own lack of sufficient funds, and its lack of advanced defense technology. His successors would offer similar statements as well.16

Seoul may well have been wary of involvement in a defense architecture that could be seen as participating in the “**containment**” of China; keeping China closer to the ROK than the DPRK has been an important South Korean objective since the end of the Cold War. Minister Chun’s reference to defense technology was perhaps even more significant, reflecting the yearning to achieve greater self-reliance in defense. Always being in need of superior foreign technology for national defense would mean that the ROK would never be able to choose its own course.17 Implicitly, if the DPRK could build its own missiles to threaten the ROK, then the ROK should be able to make its own missile defenses, not to mention missiles for threatening retaliation, unless it was content to rely permanently on the protection of the United States. Under the presidency of Kim Dae-jung, too, South Korea’s approach to the North leaned toward diplomacy and aid rather than new defense expenditures.

Although South Korea was too hard-pressed financially to invest the anticipated roughly one trillion won (about $1 billion) needed to acquire a state-of-the-art theater BMD system like PAC3, it was able to set aside about 10 billion won (about $10 million) for the Agency for Defense Development (ADD) to start development of an indigenous “medium-range surface-to-air missile,” or M-SAM, starting in 1998. (ADD is the developer of South Korea’s indigenous missile systems, which bear a close visual resemblance to Russian short-range ballistic missiles.) This small effort was expected to take a decade to bear fruit, and was described at the outside as involving the assistance from “Russia and other advanced countries.”18

Over time, M-SAM would be portrayed as an anti-aircraft weapon, designed to replace older U.S.-supplied Hawk SAMs. The first production M-SAM systems, renamed Cheongung, were deployed to the Northwest Islands by early 2016.19 In the meantime, the X-SAM program, which was supposed to fill the gap in South Korea’s defenses by acquiring PAC-3 or its equivalent, continued to make little progress. The MND failed to find a viable path for acquisition until 2005, when it identified a solution in the form of secondhand Patriot PAC-2 systems owned by Germany.20 The ensuing negotiation would last years.

The Korean Air and Missile Defense (KAMD) Concept

Another reason for the slow path to acquisition of BMD was, in all likelihood, a lack of urgency. After the launch of the TD-1 over Japan in August 1998, North Korea had agreed to a moratorium in space launches and missile tests. Pyongyang adhered to this policy of restraint until July 2006, when it flight-tested a barrage of theater ballistic missiles, along with a threestage TD-2 launcher. In October 2006, it conducted its first nuclear test. Later that year, South Korea announced the development of a new BMD architecture, the Korean Air and Missile Defense (KAMD), which officials described as “affordable.” Early media accounts of KAMD described it as featuring a network of Patriot batteries, a new, indigenously developed earlywarning radar, and its own dedicated command center.21 In 2008, Seoul’s Defense Acquisition Program Administration (DAPA) finally concluded the purchase of the secondhand German PAC-2s, to be linked by new fire-control systems from Raytheon. The first shipment from Germany arrived in South Korea late that year, about 13 years after the initial decision to replace the superannuated Nike-Hercules. The newly acquired interceptors were deployed around ROK Air Force bases.22

Now apparently feeling some urgency to erect a national BMD system, Seoul set aside the idea of an indigenous early-warning radar. In fall 2009, DAPA decided to purchase two Super Green Pine radars from Israel’s Elta. These radars were originally designed to work with the Arrow BMD interceptor jointly developed by the United States and Israel.23 Thus, KAMD was taking shape rapidly, with a minimum of equipment purchased directly from the United States. But even as South Korea continued to receive shipments of old PAC-2 equipment from Germany, the MND concluded that these systems were ineffective against the North Korean missile threat. The equipment was outmoded and better suited to intercepting aircraft than missiles. The aging PAC-2 tracking radars broke down frequently and proved difficult to maintain.24

In consultations with the United States in late 2012, the government expressed renewed interest in acquiring new PAC-3 systems, to be deployed at an early date.25 The U.S. Department of Defense received formal notice of Seoul’s interest in a possible purchase in October 2013.26 Indeed, as early as 2008, descriptions of KAMD future development had broadened to include new U.S.-made interceptors, in the form of Raytheon’s SM-2 missiles, to be deployed abroad South Korea’s new Aegis-class destroyers.27 Later accounts also indicated an interest in the SM6 interceptor, then under development.28 Two other new acquisition tracks also emerged under the KAMD umbrella. The first was naval, and moved briskly. As early as January 2008, descriptions of the architecture’s future development broadened to include Raytheon’s SM-2 missiles, to be deployed aboard the ROK Navy’s new Aegis-capable destroyers.29 Perhaps reflecting ambivalence within Seoul, the purchase and delivery of SM-2s have not been highly publicized. A DOD notice from May 2009 documenting South Korean interest in buying a batch of SM-2s noted that the ROK “already has these missiles in its inventory.”30 (Some SM-2s would be displayed in an October 2013 Armed Forces Day parade in Seoul.) Later accounts also expressed interest in acquiring the new SM-6 multi-role naval missile, which operates in both defensive and anti-ship modes.31 The second acquisition track involved more indigenous systems. At the same time that the shortcomings of the German PAC-2s were first brought before the public eye, MND also revealed news plans for developing another indigenous BMD interceptor, a program called LSAM.32 L-SAM has been depicted as an upper-tier interceptor for a layered defense, with the lower tier composed of PAC-3 and M-SAM batteries.33 This high-altitude intercept role may suggest an additional, unstated reason for Seoul’s early reluctance to discuss an American THAAD deployment to Korea; although THAAD is expected to be USFK’s system, and not South Korea’s, its presence in Korea might undercut the rationale for L-SAM.

Regardless of the exact configuration, the rapid emergence of the initial KAMD system seems to have pushed U.S.-ROK discussions toward the subject of interoperability between allied defense systems. South Korean Ministers of National Defense issued essentially identical pledges to achieve this goal in each joint statement of the annual ministerial-level U.S.-ROK Security Consultative Meeting (SCM) since 2012.34

Despite the operational advantages of having defensive assets exchange data and coordinate actions in combat, interoperability appears to have been a source of discomfort for the South Koreans. American officials may have contributed to that discomfort by linking the theme of interoperability to the unpopular subject of trilateral defense cooperation with Japan, speaking in terms of “an interoperable regional missile defense architecture.”35

Perhaps the first concrete indication of progress on interoperability appeared in January 2016, when the MND announced plans to install a Link 16 tactical data link between the allies’ respective BMD command centers at Osan Air Base.36 The U.S. BMD system uses Link 16 to connect the other elements of the system to a Command and Control, Battle Management, and Communications System.37 The MND announcement emphasized that the data link would run only between the two command centers, which implicitly will remain separate despite their proximity, and will not have direct and unmediated access to each other’s BMD assets. Shortly thereafter, it was also announced that the allies would undertake a joint BMD exercise during the annual spring military exercises.38 For the time being, at least, this modest level of interoperability seems to represent the extent of Seoul’s willingness.

Conclusions and recommendations

Overall, KAMD seems to have had little in the way of a consistent system design, and remains very much a work in progress. It has emerged as a patchwork quilt—an improvisational assemblage of technologies from a variety of foreign and domestic suppliers. Its only fixed characteristic is the first word in its name: Korean. Whatever form it may take, KAMD is the national BMD system of the Republic of Korea, as opposed to a joint or regional architecture. This pattern reflects Seoul’s tendency to respond to a variety of pressures and concerns by delaying acquisition of big-ticket American systems, selecting low-cost alternatives when possible, and investing in locally produced alternatives, all while insisting on the maximum operational autonomy. It is invariably North Korean missile and nuclear tests that have spurring greater interest in BMD in Seoul and, at least temporarily, greater willingness to collaborate with the United States in the BMD field.

As a result, South Korean defense officials have improvised a meandering course on BMD development and acquisition, now steering closer to their American partners, now further away. American officials may periodically get an impression of progress, but so far that progress remains tentative and incremental. With time, as Seoul’s technological capabilities mature, it is likely to **shift** **toward** an **increasingly** **independent** defense **posture**. Short of a fundamental shift in South Korean views on defense technology, national autonomy, or regional politics and security, no trilateral BMD system including the U.S. and Japan should be expected to take shape.

A certain tension can be seen in South Korea’s approach: the desire to keep costs under control conflicts with the goal of avoiding integration into a joint or multinational architecture. A multinational approach would presumably offer the best value in terms of operational effectiveness, since it would involve relatively mature technologies and take advantage of investments already made by foreign partners. Insisting on a low-cost approach to BMD has actually forced Seoul to accept some degree of dependence. For example, ROK defense officials have felt compelled to explain to reporters that a data link between command centers is desirable, since it will give South Korea access to U.S. space-based early warning data—something the ROK cannot afford to duplicate.

Faced with this situation, perhaps the most constructive approach for the United States would be to consider proposing a jointly developed U.S.-ROK defensive architecture, separate from its U.S.-Japanese equivalent, which would create a joint capability at substantial cost savings for South Korea. While this approach would not resolve all South Korean concerns, it would help to remove the most acute issue. Despite a desire for greater freedom of action, as well as anxiety about the intentions of U.S. President-elect Donald Trump, South Korea’s leaders are far from ready to separate themselves from their alliance from the United States. The continuing USFK Missile Defense, Extended Deterrence, and Nonproliferation in the 21st Century | Paper 4 8 presence helps to deter serious North Korean aggression, and may even be seen as offering a counterweight to China’s growing military power. Seoul’s interest in BMD has grown since the end of the North Korean missile-test moratorium and the first North Korean nuclear test, both in 2006, so a jointly developed system is not out of the question.

**Escalation ladder ensures nuke war---alliance and strategy cohesion is key.**

Bush 17 (, R., 2017. The real reason a North Korean nuclear weapon is so terrifying—and it’s not what you think. [online] Brookings. Available at: <https://www.brookings.edu/blog/order-from-chaos/2017/08/09/the-real-reason-a-north-korean-nuclear-weapon-is-so-terrifying-and-its-not-what-you-think/> [Accessed 12 January 2022] Richard C. Bush III is an American expert on China affairs. Since 2002, he has served as the director of Center for Northeast Asian Policy Studies of the Brookings Institution, and concurrently as the inaugural Michael H. Armacost Chair in Foreign Policy Studies. Bush is also a senior fellow of foreign policy.)-recut rahulpenu

There is general agreement in Washington—and Seoul and Tokyo—that East Asia and the world will be a more dangerous place once **No**rth **Ko**rea achieves its declared goal of being able to hit the continental **U**nited **S**tates with nuclear weapons. But what is the danger, specifically? Many people aren’t clear. In my view, it’s less about the actual ability of North Korea to hit the continental United States with a nuclear weapon. Rather, the real danger stems from the possibility of **weakened alliances** and unchecked escalation in the Korean Peninsula that could spiral out of control. DETER AND PROTECT, CALLED INTO QUESTIONThe Trump administration seems to believe that even North Korea’s ability to reliably hit the United States with nuclear weapons is so dangerous that it must prevent that from happening. Yet how it intends to do that is unclear. On August 8, President Trump threatened strong military action, but he seemed to forget the almost certain North Korean retaliation against South Korea, our ally, if we took such actions. Then there is the belief that “maximum pressure” by the United States, China, and others will bring North Korea to the negotiating table, where it will be willing to trade away or at least freeze its nuclear and missile programs. That ignores the reality that the Kim Jong-un regime wants to achieve the ability to hit the United States with nuclear weapons so badly, there is no package of incentives that would be acceptable to Washington and Seoul that would lead Pyongyang to abandon its goal. But even when—not if—North Korea has the ability to strike the United States, that does not mean it will use that capability against us. Indeed, in my view, the danger that North Korea would launch a nuclear first strike against the United States or its allies—Japan or South Korea—is relatively small. Pyongyang says that it is going nuclear in order to deter the more powerful United States from launching a nuclear or conventional war against it. Although North Korea is actually wrong in its assessment of the threat the United States poses, its desire to enhance its security by being able to retaliate after such an imagined attack is understandable. It would not be the first country to employ that deterrence logic. **So**uth **Ko**rean and Japanese **security** specialists point to a more serious danger. They remind us, correctly, that their countries have depended for their own security on the credible commitment of the **U**nited **S**tates to use **all available means** to defend them from attack by **No**rth **Ko**rea, including retaliation with nuclear weapons if necessary. Among other things, Japan and South Korea have chosen not to acquire nuclear weapons themselves because they believe in the U.S. nuclear umbrella. (South Korea had started on a nuclear program in the 1970s but the Ford administration shut it down. Japan has considered starting a program at various times but in the end never wished to risk the U.S.-Japan alliance.). As North Korea’s quest is getting closer to success, **skepticism in Seoul** and Tokyo **about** credibility of the American commitment is increasing. Reasonably, the skeptics ask, if North Korea attacked them, would Washington be willing to retaliate with nuclear weapons when North Korea would be able and probably willing to counter-retaliate by hitting America? Would Washington be willing to risk San Francisco in order to save Seoul or Tokyo? The United States faced this fear of “de-coupling” in Europe during the Cold War. Britain and France, knowing that nothing could match the conventional forces of the Soviet Union in Western Europe, each preferred to have their own independent nuclear deterrent as a hedge against a U.S. loss of nerve. On the other hand, Washington was able to convince West Germany to remain nuclear-free but it required a lot of effort. **Thinking ahead**, the Obama administration began a campaign to persuade Japanese and South Korean leaders to follow the path of Germany and rely on their U.S. alliances. But that job will only get harder as North Korea gets closer to its goal. THE ESCALATION SPIRAL North Korea’s nuclear program poses another danger, perhaps the greatest one. Pyongyang may soon assume that it can **now** act more recklessly vis-à-vis South Korea **at the conventional level** and well short of a major attack because it can hypothetically counter the United States at the nuclear level. **The scenario I have in mind is one in which** North Korea starts at a relatively low rung of the escalation ladder: sinking a **South Korean naval** vessel, bombarding South Korean-controlled islands in the West Sea, or creating trouble in the **d**e**m**ilitarized **z**one. It has done all of these things **in the last seven years** but then backed off from further conflict. Once Pyongyang can target the continental **U**nited **S**tates, it will likely take **bigger risks** than it has **to date**. It would undertake such **limited-war** actions as much to achieve political gains as military ones. It would hope to test South Korean intentions and try to drive wedges within South Korean society: between the military on the one hand and President Moon’s dovish advisers on the other; between conservative parties and progressive ones; between segments of the public that don’t want to see their country pushed around and those who worry about Seoul’s vulnerability. Where President Moon would come out is anybody’s guess. A second purpose would be to provoke tensions within the **U.S.-ROK** alliance. In such a crisis, there might be disagreements on how severely the South Korean armed forces should retaliate against North Korean aggression. South Korea might not wish to appear weak, in order to deter future humiliations. The United States might fear that things would get out of hand and urge restraint. The safety of the residents of Seoul, which is within range of North Korean artillery close to the DMZ, would rightly be a fundamental concern. But **it is neither in South Korea’s interest or ours to give Pyongyang reason to think** that **the U**nited **S**tates **has lost confidence in our ally. In this situation,** the danger of reciprocal escalation even as far as the use of nuclear weapons would be real. We lack understandings with Pyongyang of the sort we had with the Soviet Union during the Cold War, such as **communications channels** to reduce the risk of **misperception** and **miscalc**ulation. But even if escalation were controlled and Pyongyang didn’t get close to using nuclear weapons, the very existence of those weapons would weigh on the minds of South Korean leaders and citizens and U.S. decisionmakers. Again, North Korea’s goal here would be political. Pyongyang would hope that the Moon administration would opt for a weak response rather than a tough one—in that case, North Korea would have humiliated South Korea and won a political victory. If Moon chose a tough response, North Korea could back down, not having lost very much, or it could escalate one round, again to see what South Korea does in response. But it would **believe** that **it controls the escalation ladder** and assume that **at some point,** Seoul would choose **appease**ment. The United States would likely end up in a no-win situation as a result of these episodes. Even if coordination with the South Korean military were smooth, some parts of the South Korean society would be unhappy. Either conservatives in Korea would conclude that we haven’t been tough enough and so doubt our resolve in the future, or progressives would conclude that we have been too assertive and that their country needs to move to a more autonomous defense. Whatever happens, it’s probably a political win for North Korea. Pyongyang could well believe that it has nothing to lose by testing South Korean resolve and ours. **How we respond to** these **low-level probes will** cumulatively **shape** South Korean **confidence** in the United States, **for good or ill.** Even though these crises stay in the conventional realm, they will affect South Korean thinking about what we would do if another crisis escalated **toward the nuclear level.** In addition, how Washington and Seoul respond **at low levels** will also cumulatively **shape the risks that North Korea is willing to run**. The **U**nited **S**tates **needs to assume that North Korean conventional probes will come**, sooner or later. It is far better Washington to formulate our responses **in advance** and urge the South Koreans to do the same, in order to reduce the chances that we will bungle our reaction when these more aggressive provocations occur.

**Lack of alliance credibility causes East Asian war---escalation, miscalc, and cyberattacks.**

**Sukin and Dalton 21** Lauren Sukin, 10-26-2021, (Lauren Sukin is a Ph.D. candidate at Stanford University’s department of political science and a pre-doctoral fellow at the Center for International Security and Cooperation. Toby Dalton is a senior fellow at, and co-director of, the Nuclear Policy Program at the Carnegie Endowment for International Peace.)"Why South Korea Shouldn’t Build Its Own Nuclear Bombs," War on the Rocks, <https://warontherocks.com/2021/10/why-south-korea-shouldnt-build-its-own-nuclear-bombs/> //Jay

Lind and Press also point to alliance credibility challenges as a reason why South Korea should build its own nuclear weapons. They are certainly not alone in warning that U.S. nuclear credibility may be crumbling, yet there is plenty of evidence indicating the political and military foundations of the U.S.-South Korean defense relationship remain strong. Recent public opinion surveys by the Chicago Council for Global Affairs showed that 62 percent of Americans support the use of U.S. military forces to defend South Korea against a North Korean attack. This is matched by attitudes in South Korea, where the public also continues to express high levels of support for, and confidence in, the alliance. A September 2021 Asan Institute poll, for example, showed 78 percent support for maintaining or strengthening the U.S.-South Korean alliance. Proponents of a South Korean nuclear weapons program argue, however, that South Koreans are no longer confident in the United States — they point to high levels of public support for nuclear proliferation (70 percent in the recent Asan poll) and concerns that South Korea’s military alone is not sufficient to deter North Korea (72 percent, according to Asan). But deeper research paints a more nuanced picture of the credibility challenge. For example, research by Lauren Sukin found that, in 2019, 58 percent of South Korean survey respondents believed the United States would use nuclear weapons to defend South Korea from a North Korean nuclear attack. Other work shows robust U.S. public support for the nuclear security guarantee to South Korea. Scholars have similarly found that the U.S. public is willing to use nuclear weapons, including against North Korea, and even when there is a high risk of nuclear retaliation. So the claim by Lind and Press that “South Korea can’t be sure it can depend on its U.S. ally for protection” seems overblown. This is not to argue that concerns about alliance credibility have no basis. Building confidence in the alliance among the South Korean public is an ongoing challenge, made much harder in the wake of the Trump administration’s extortionate approach to alliance burden-sharing negotiations. South Koreans were also alarmed in 2017 that President Donald Trump’s “fire and fury” might result in a war they did not want. Yet, neither of these are problems are fundamentally about the reliability of U.S. promises to aid South Korea in a security crisis. Rather, they point to a need for better alliance political and military cohesion, especially coordination about contingencies involving North Korea that could escalate to use of nuclear weapons. In sum, alliance credibility problems are real but not as severe as many have suggested, and nuclear weapons are far from a clear remedy for the problems that persist. **Would Nuclear Weapons Improve South Korean Security?** Even if the alliance problems were as profound as some analysts contend — and if South Korean nuclear proliferation did not somehow make them worse — a South Korean decision to acquire nuclear weapons would not necessarily improve Seoul’s security against North Korea or China, as advocates have claimed. Indeed, a lot would depend on how North Korea and China would react to South Korean proliferation. South Korean nuclear weapons may not be especially useful politico-military tools against China. U.S. nuclear threats against China during the Korean War did not dissuade Beijing from continuing to fight. Nor has China hesitated to leverage its conventional military strength in territorial contests with nuclear-armed India. China’s ongoing modernization of its nuclear forces — whether by constructing missile silos or testing hypersonics — suggests Beijing may view the survivability and effectiveness of its arsenal as vital for deterring the United States, especially in the Taiwan Strait. Would South Korean nuclear weapons dissuade Beijing from undertaking coercive operations against Seoul? It seems unlikely. If anything, South Korean proliferation could plausibly invite more **coercive Chinese economic and military pressures** if Beijing interpreted Seoul’s nuclear arsenal as a direct challenge to its regional aspirations. Vis-à-vis China, then, South Korea could wind up counterintuitively less secure with nuclear weapons than without them. South Korean nuclear weapons could similarly make the situation with North Korea much more dangerous. Already, joint U.S.-South Korean military exercises, which Pyongyang calls “exercises for a nuclear war,” have repeatedly prompted North Korea to issue aggressive rhetoric, engage in cross-border provocations, and conduct missile tests. In the face of a South Korean nuclear weapons program, it would be unreasonable to expect North Korea to take no countervailing actions. For example, it seems likely that South Korean proliferation could cause N**orth Korea to further augment** its nuclear arsenal, posture its nuclear weapons for first use, or take greater risks to gain the upper hand in an escalating military crisis. After all, even the United States, with its far superior nuclear arsenal, has had limited success deterring or compelling North Korea. Moreover, even if South Korean nuclear weapons likely would deter large-scale violence by China or North Korea, they could make the threat of low-level conflict escalation greater than it already is today. This is especially important in the Indo-Pacific context, where the most prevalent threats and sources of crisis escalation — such as China’s overflights of contested territory or North Korea’s offensive use of **cyber** capabilities — exist far below the nuclear threshold. The “stability-instability paradox” of nuclear weapons suggests that, although mutual possession of nuclear weapons may reduce the chances of nuclear war, it may, at the same time, make conventional wars and militarized crises more likely, as well as incentivize greater risk taking at lower levels. A more moderated version of this argument suggests that nuclear weapons may not necessarily make low-level conflict more likely, but neither do they prevent it. For instance, a nuclear-armed South Korea could be emboldened to respond more aggressively to North Korean provocations with proactive deterrence or “quid pro quo plus” military operations, the inherent escalation risks of which are intended to dissuade North Korea in the first place. Facing perceived “use or lose” pressures, North Korea may be quicker to cross certain **escalation** thresholds, such as the use of long-range rocket systems, as it seeks escalation dominance. The potential for these action-reaction dynamics to spiral into a race up the escalation ladder is clear. To be certain, this potential is already present, but it seems likely to worsen if South Korea possessed nuclear weapons. Reaction times during moments of crisis would be shorter, tensions higher; **miscommunication** and misperception easier, and nuclear use more accessible. South Korean proliferation could, then, make conflict more likely at worst and fail to deter it at best.

### 1AC---Framing

#### 1---Pleasure and pain *are* intrinsic value and disvalue – everything else *regresses* – robust neuroscience.

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**Pleasure** is not only one of the three primary reward functions but it also **defines reward.** As homeostasis explains the functions of only a limited number of rewards, the principal reason why particular stimuli, objects, events, situations, and activities are rewarding may be due to pleasure. This applies first of all to sex and to the primary homeostatic rewards of food and liquid and extends to money, taste, beauty, social encounters and nonmaterial, internally set, and intrinsic rewards. Pleasure, as the primary effect of rewards, drives the prime reward functions of learning, approach behavior, and decision making and provides the **basis for hedonic theories** of reward function. We are attracted by most rewards and exert intense efforts to obtain them, just because they are enjoyable [10].

Pleasure is a passive reaction that derives from the experience or prediction of reward and may lead to a long-lasting state of happiness. The word happiness is difficult to define. In fact, just obtaining physical pleasure may not be enough. One key to happiness involves a network of good friends. However, it is not obvious how the higher forms of satisfaction and pleasure are related to an ice cream cone, or to your team winning a sporting event. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure [14].

Pleasure as a hallmark of reward is sufficient for defining a reward, but it may not be necessary. A reward may generate positive learning and approach behavior simply because it contains substances that are essential for body function. When we are hungry, we may eat bad and unpleasant meals. A monkey who receives hundreds of small drops of water every morning in the laboratory is unlikely to feel a rush of pleasure every time it gets the 0.1 ml. Nevertheless, with these precautions in mind, we may define any stimulus, object, event, activity, or situation that has the potential to produce pleasure as a reward. In the context of reward deficiency or for disorders of addiction, homeostasis pursues pharmacological treatments: drugs to treat drug addiction, obesity, and other compulsive behaviors. The theory of allostasis suggests broader approaches - such as re-expanding the range of possible pleasures and providing opportunities to expend effort in their pursuit. [15]. It is noteworthy, the first animal studies eliciting approach behavior by electrical brain stimulation interpreted their findings as a discovery of the brain’s pleasure centers [16] which were later partly associated with midbrain dopamine neurons [17–19] despite the notorious difficulties of identifying emotions in animals.

Evolutionary theories of pleasure: The love connection BO:D

Charles Darwin and other biological scientists that have examined the biological evolution and its basic principles found various mechanisms that steer behavior and biological development. Besides their theory on natural selection, it was particularly the sexual selection process that gained significance in the latter context over the last century, especially when it comes to the question of what makes us “what we are,” i.e., human. However, the capacity to sexually select and evolve is not at all a human accomplishment alone or a sign of our uniqueness; yet, we humans, as it seems, are ingenious in fooling ourselves and others–when we are in love or desperately search for it.

It is well established that modern biological theory conjectures that **organisms are** the **result of evolutionary competition.** In fact, Richard Dawkins stresses gene survival and propagation as the basic mechanism of life [20]. Only genes that lead to the fittest phenotype will make it. It is noteworthy that the phenotype is selected based on behavior that maximizes gene propagation. To do so, the phenotype must survive and generate offspring, and be better at it than its competitors. Thus, the ultimate, distal function of rewards is to increase evolutionary fitness by ensuring the survival of the organism and reproduction. It is agreed that learning, approach, economic decisions, and positive emotions are the proximal functions through which phenotypes obtain other necessary nutrients for survival, mating, and care for offspring.

Behavioral reward functions have evolved to help individuals to survive and propagate their genes. Apparently, people need to live well and long enough to reproduce. Most would agree that homo-sapiens do so by ingesting the substances that make their bodies function properly. For this reason, foods and drinks are rewards. Additional rewards, including those used for economic exchanges, ensure sufficient palatable food and drink supply. Mating and gene propagation is supported by powerful sexual attraction. Additional properties, like body form, augment the chance to mate and nourish and defend offspring and are therefore also rewards. Care for offspring until they can reproduce themselves helps gene propagation and is rewarding; otherwise, many believe mating is useless. According to David E Comings, as any small edge will ultimately result in evolutionary advantage [21], additional reward mechanisms like novelty seeking and exploration widen the spectrum of available rewards and thus enhance the chance for survival, reproduction, and ultimate gene propagation. These functions may help us to obtain the benefits of distant rewards that are determined by our own interests and not immediately available in the environment. Thus the distal reward function in gene propagation and evolutionary fitness defines the proximal reward functions that we see in everyday behavior. That is why foods, drinks, mates, and offspring are rewarding.

There have been theories linking pleasure as a required component of health benefits salutogenesis, (salugenesis). In essence, under these terms, pleasure is described as a state or feeling of happiness and satisfaction resulting from an experience that one enjoys. Regarding pleasure, it is a double-edged sword, on the one hand, it promotes positive feelings (like mindfulness) and even better cognition, possibly through the release of dopamine [22]. But on the other hand, pleasure simultaneously encourages addiction and other negative behaviors, i.e., motivational toxicity. It is a complex neurobiological phenomenon, relying on reward circuitry or limbic activity. It is important to realize that through the “Brain Reward Cascade” (BRC) endorphin and endogenous morphinergic mechanisms may play a role [23]. While natural rewards are essential for survival and appetitive motivation leading to beneficial biological behaviors like eating, sex, and reproduction, crucial social interactions seem to further facilitate the positive effects exerted by pleasurable experiences. Indeed, experimentation with addictive drugs is capable of directly acting on reward pathways and causing deterioration of these systems promoting hypodopaminergia [24]. Most would agree that pleasurable activities can stimulate personal growth and may help to induce healthy behavioral changes, including stress management [25]. The work of Esch and Stefano [26] concerning the link between compassion and love implicate the brain reward system, and pleasure induction suggests that social contact in general, i.e., love, attachment, and compassion, can be highly effective in stress reduction, survival, and overall health.

Understanding the role of neurotransmission and pleasurable states both positive and negative have been adequately studied over many decades [26–37], but comparative anatomical and neurobiological function between animals and homo sapiens appear to be required and seem to be in an infancy stage.

Finding happiness is different between apes and humans

As stated earlier in this expert opinion one key to happiness involves a network of good friends [38]. However, it is not entirely clear exactly how the higher forms of satisfaction and pleasure are related to a sugar rush, winning a sports event or even sky diving, all of which augment dopamine release at the reward brain site. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure.

Remarkably, there are pathways for ordinary liking and pleasure, which are limited in scope as described above in this commentary. However, there are **many brain regions**, often termed hot and cold spots, that significantly **modulate** (increase or decrease) our **pleasure or** even produce **the opposite** of pleasure— that is disgust and fear [39]. One specific region of the nucleus accumbens is organized like a computer keyboard, with particular stimulus triggers in rows— producing an increase and decrease of pleasure and disgust. Moreover, the cortex has unique roles in the cognitive evaluation of our feelings of pleasure [40]. Importantly, the interplay of these multiple triggers and the higher brain centers in the prefrontal cortex are very intricate and are just being uncovered.

Desire and reward centers

It is surprising that many different sources of pleasure activate the same circuits between the mesocorticolimbic regions (Figure 1). Reward and desire are two aspects pleasure induction and have a very widespread, large circuit. Some part of this circuit distinguishes between desire and dread. The so-called pleasure circuitry called “REWARD” involves a well-known dopamine pathway in the mesolimbic system that can influence both pleasure and motivation.

In simplest terms, the well-established mesolimbic system is a dopamine circuit for reward. It starts in the ventral tegmental area (VTA) of the midbrain and travels to the nucleus accumbens (Figure 2). It is the cornerstone target to all addictions. The VTA is encompassed with neurons using glutamate, GABA, and dopamine. The nucleus accumbens (NAc) is located within the ventral striatum and is divided into two sub-regions—the motor and limbic regions associated with its core and shell, respectively. The NAc has spiny neurons that receive dopamine from the VTA and glutamate (a dopamine driver) from the hippocampus, amygdala and medial prefrontal cortex. Subsequently, the NAc projects GABA signals to an area termed the ventral pallidum (VP). The region is a relay station in the limbic loop of the basal ganglia, critical for motivation, behavior, emotions and the “Feel Good” response. This defined system of the brain is involved in all addictions –substance, and non –substance related. In 1995, our laboratory coined the term “Reward Deficiency Syndrome” (RDS) to describe genetic and epigenetic induced hypodopaminergia in the “Brain Reward Cascade” that contribute to addiction and compulsive behaviors [3,6,41].

Furthermore, ordinary “liking” of something, or pure pleasure, is represented by small regions mainly in the limbic system (old reptilian part of the brain). These may be part of larger neural circuits. In Latin, hedus is the term for “sweet”; and in Greek, hodone is the term for “pleasure.” Thus, the word Hedonic is now referring to various subcomponents of pleasure: some associated with purely sensory and others with more complex emotions involving morals, aesthetics, and social interactions. The capacity to have pleasure is part of being healthy and may even extend life, especially if linked to optimism as a dopaminergic response [42].

Psychiatric illness often includes symptoms of an abnormal inability to experience pleasure, referred to as anhedonia. A negative feeling state is called dysphoria, which can consist of many emotions such as pain, depression, anxiety, fear, and disgust. Previously many scientists used animal research to uncover the complex mechanisms of pleasure, liking, motivation and even emotions like panic and fear, as discussed above [43]. However, as a significant amount of related research about the specific brain regions of pleasure/reward circuitry has been derived from invasive studies of animals, these cannot be directly compared with subjective states experienced by humans.

In an attempt to resolve the controversy regarding the causal contributions of mesolimbic dopamine systems to reward, we have previously evaluated the three-main competing explanatory categories: “liking,” “learning,” and “wanting” [3]. That is, dopamine may mediate (a) liking: the hedonic impact of reward, (b) learning: learned predictions about rewarding effects, or (c) wanting: the pursuit of rewards by attributing incentive salience to reward-related stimuli [44]. We have evaluated these hypotheses, especially as they relate to the RDS, and we find that the incentive salience or “wanting” hypothesis of dopaminergic functioning is supported by a majority of the scientific evidence. Various neuroimaging studies have shown that anticipated behaviors such as sex and gaming, delicious foods and drugs of abuse all affect brain regions associated with reward networks, and may not be unidirectional. Drugs of abuse enhance dopamine signaling which sensitizes mesolimbic brain mechanisms that apparently evolved explicitly to attribute incentive salience to various rewards [45].

Addictive substances are voluntarily self-administered, and they enhance (directly or indirectly) dopaminergic synaptic function in the NAc. This activation of the brain reward networks (producing the ecstatic “high” that users seek). Although these circuits were initially thought to encode a set point of hedonic tone, it is now being considered to be far more complicated in function, also encoding attention, reward expectancy, disconfirmation of reward expectancy, and incentive motivation [46]. The argument about addiction as a disease may be confused with a predisposition to substance and nonsubstance rewards relative to the extreme effect of drugs of abuse on brain neurochemistry. The former sets up an individual to be at high risk through both genetic polymorphisms in reward genes as well as harmful epigenetic insult. Some Psychologists, even with all the data, still infer that addiction is not a disease [47]. Elevated stress levels, together with polymorphisms (genetic variations) of various dopaminergic genes and the genes related to other neurotransmitters (and their genetic variants), and may have an additive effect on vulnerability to various addictions [48]. In this regard, Vanyukov, et al. [48] suggested based on review that whereas the gateway hypothesis does not specify mechanistic connections between “stages,” and does not extend to the risks for addictions the concept of common liability to addictions may be more parsimonious. The latter theory is grounded in genetic theory and supported by data identifying common sources of variation in the risk for specific addictions (e.g., RDS). This commonality has identifiable neurobiological substrate and plausible evolutionary explanations.

Over many years the controversy of dopamine involvement in especially “pleasure” has led to confusion concerning separating motivation from actual pleasure (wanting versus liking) [49]. We take the position that animal studies cannot provide real clinical information as described by self-reports in humans. As mentioned earlier and in the abstract, on November 23rd, 2017, evidence for our concerns was discovered [50]

In essence, although nonhuman primate brains are similar to our own, the disparity between other primates and those of human cognitive abilities tells us that surface similarity is not the whole story. Sousa et al. [50] small case found various differentially expressed genes, to associate with pleasure related systems. Furthermore, the dopaminergic interneurons located in the human neocortex were absent from the neocortex of nonhuman African apes. Such differences in neuronal transcriptional programs may underlie a variety of neurodevelopmental disorders.

In simpler terms, the system controls the production of dopamine, a chemical messenger that plays a significant role in pleasure and rewards. The senior author, Dr. Nenad Sestan from Yale, stated: “Humans have evolved a dopamine system that is different than the one in chimpanzees.” This may explain why the behavior of humans is so unique from that of non-human primates, even though our brains are so surprisingly similar, Sestan said: “It might also shed light on why people are vulnerable to mental disorders such as autism (possibly even addiction).” Remarkably, this research finding emerged from an extensive, multicenter collaboration to compare the brains across several species. These researchers examined 247 specimens of neural tissue from six humans, five chimpanzees, and five macaque monkeys. Moreover, these investigators analyzed which genes were turned on or off in 16 regions of the brain. While the differences among species were subtle, **there was** a **remarkable contrast in** the **neocortices**, specifically in an area of the brain that is much more developed in humans than in chimpanzees. In fact, these researchers found that a gene called tyrosine hydroxylase (TH) for the enzyme, responsible for the production of dopamine, was expressed in the neocortex of humans, but not chimpanzees. As discussed earlier, dopamine is best known for its essential role within the brain’s reward system; the very system that responds to everything from sex, to gambling, to food, and to addictive drugs. However, dopamine also assists in regulating emotional responses, memory, and movement. Notably, abnormal dopamine levels have been linked to disorders including Parkinson’s, schizophrenia and spectrum disorders such as autism and addiction or RDS.

Nora Volkow, the director of NIDA, pointed out that one alluring possibility is that the neurotransmitter dopamine plays a substantial role in humans’ ability to pursue various rewards that are perhaps months or even years away in the future. This same idea has been suggested by Dr. Robert Sapolsky, a professor of biology and neurology at Stanford University. Dr. Sapolsky cited evidence that dopamine levels rise dramatically in humans when we anticipate potential rewards that are uncertain and even far off in our futures, such as retirement or even the possible alterlife. This may explain what often motivates people to work for things that have no apparent short-term benefit [51]. In similar work, Volkow and Bale [52] proposed a model in which dopamine can favor NOW processes through phasic signaling in reward circuits or LATER processes through tonic signaling in control circuits. Specifically, they suggest that through its modulation of the orbitofrontal cortex, which processes salience attribution, dopamine also enables shilting from NOW to LATER, while its modulation of the insula, which processes interoceptive information, influences the probability of selecting NOW versus LATER actions based on an individual’s physiological state. This hypothesis further supports the concept that disruptions along these circuits contribute to diverse pathologies, including obesity and addiction or RDS.

#### 2---Indifference – Even if there are apriori moral truths, I can choose to ignore them. Cognition is binding – if I put my hand on a hot stove, I can’t turn off my natural aversion to it.

#### 3---Weigh magnitude times probability---“probability first” framing is rooted in psychological biases and leads to mass death

Clarke 08 [Lee, member of a National Academy of Science committee that considered decision-making models, Anschutz Distinguished Scholar at Princeton University, Fellow of AAAS, Professor Sociology (Rutgers), Ph.D. (SUNY), “Possibilistic Thinking: A New Conceptual Tool for Thinking about Extreme Events,” Fall, Social Research 75.3, JSTOR]

In scholarly work, the subfield of disasters is often seen as narrow. One reason for this is that a lot of scholarship on disasters is practically oriented, for obvious reasons, and the social sciences have a deep-seated suspicion of practical work. This is especially true in sociology. Tierney (2007b) has treated this topic at length, so there is no reason to repeat the point here. There is another, somewhat unappreciated reason that work on disaster is seen as narrow, a reason that holds some irony for the main thrust of my argument here: disasters are unusual and the social sciences are generally biased toward phenomena that are frequent. Methods textbooks caution against using case stud- ies as representative of anything, and articles in mainstreams journals that are not based on probability samples must issue similar obligatory caveats. The premise, itself narrow, is that the only way to be certain that we know something about the social world, and the only way to control for subjective influences in data acquisition, is to follow the tenets of probabilistic sampling. This view is a correlate of the central way of defining rational action and rational policy in academic work of all varieties and also in much practical work, which is to say in terms of probabilities. The irony is that probabilistic thinking has its own biases, which, if unacknowledged and uncorrected for, lead to a conceptual neglect of extreme events. This leaves us, as scholars, paying attention to disasters only when they happen and doing that makes the accumulation of good ideas about disaster vulnerable to issue-attention cycles (Birkland, 2007). These conceptual blinders lead to a neglect of disasters as "strategic research sites" (Merton, 1987), which results in learning less about disaster than we could and in missing opportunities to use disaster to learn about society (cf. Sorokin, 1942). We need new conceptual tools because of an upward trend in frequency and severity of disaster since 1970 (Perrow, 2007), and because of a growing intellectual attention to the idea of worst cases (Clarke, 2006b; Clarke, in press). For instance, the chief scientist in charge of studying earthquakes for the US Geological Service, Lucile Jones, has worked on the combination of events that could happen in California that would constitute a "give up scenario": a very long-shaking earthquake in southern California just when the Santa Anna winds are making everything dry and likely to burn. In such conditions, meaningful response to the fires would be impossible and recovery would take an extraordinarily long time. There are other similar pockets of scholarly interest in extreme events, some spurred by September 11 and many catalyzed by Katrina. The consequences of disasters are also becoming more severe, both in terms of lives lost and property damaged. People and their places are becoming more vulnerable. The most important reason that vulnerabilities are increasing is population concentration (Clarke, 2006b). This is a general phenomenon and includes, for example, flying in jumbo jets, working in tall buildings, and attending events in large capacity sports arenas. Considering disasters whose origin is a natural hazard, the specific cause of increased vulnerability is that people are moving to where hazards originate, and most especially to where the water is. In some places, this makes them vulnerable to hurricanes that can create devastating storm surges; in others it makes them vulnerable to earthquakes that can create tsunamis. In any case, the general problem is that people concentrate themselves in dangerous places, so when the hazard comes disasters are intensified. More than one-half of Florida's population lives within 20 miles of the sea. Additionally, Florida's population grows every year, along with increasing development along the coasts. The risk of exposure to a devastating hurricane is obviously high in Florida. No one should be surprised if during the next hurricane season Florida becomes the scene of great tragedy. The demographic pressures and attendant development are wide- spread. People are concentrating along the coasts of the United States, and, like Florida, this puts people at risk of water-related hazards. Or consider the Pacific Rim, the coastline down the west coasts of North and South America, south to Oceania, and then up the eastern coast- line of Asia. There the hazards are particularly threatening. Maps of population concentration around the Pacific Rim should be seen as target maps, because along those shorelines are some of the most active tectonic plates in the world. The 2004 Indonesian earthquake and tsunami, which killed at least 250,000 people, demonstrated the kind of damage that issues from the movement of tectonic plates. (Few in the United States recognize that there is a subduction zone just off the coast of Oregon and Washington that is quite similar to the one in Indonesia.) Additionally, volcanoes reside atop the meeting of tectonic plates; the typhoons that originate in the Pacific Ocean generate furiously fatal winds. Perrow (2007) has generalized the point about concentration, arguing not only that we increase vulnerabilities by increasing the breadth and depth of exposure to hazards but also by concentrating industrial facilities with catastrophic potential. Some of Perrow's most important examples concern chemical production facilities. These are facilities that bring together in a single place multiple stages of production used in the production of toxic substances. Key to Perrow's argument is that there is no technically necessary reason for such concentration, although there may be good economic reasons for it. The general point is that we can expect more disasters, whether their origins are "natural" or "technological." We can also expect more death and destruction from them. I predict we will continue to be poorly prepared to deal with disaster. People around the world were appalled with the incompetence of America's leaders and orga- nizations in the wake of Hurricanes Katrina and Rita. Day after day we watched people suffering unnecessarily. Leaders were slow to grasp the importance of the event. With a few notable exceptions, organi- zations lumbered to a late rescue. Setting aside our moral reaction to the official neglect, perhaps we ought to ask why we should have expected a competent response at all? Are US leaders and organiza- tions particularly attuned to the suffering of people in disasters? Is the political economy of the United States organized so that people, espe- cially poor people, are attended to quickly and effectively in noncri- sis situations? The answers to these questions are obvious. If social systems are not arranged to ensure people's well-being in normal times, there is no good reason to expect them to be so inclined in disastrous times. Still, if we are ever going to be reasonably well prepared to avoid or respond to the next Katrina-like event, we need to identify the barriers to effective thinking about, and effective response to, disas- ters. One of those barriers is that we do not have a set of concepts that would help us think rigorously about out-sized events. The chief toolkit of concepts that we have for thinking about important social events comes from probability theory. There are good reasons for this, as probability theory has obviously served social research well. Still, the toolkit is incomplete when it comes to extreme events, especially when it is used as a base whence to make normative judgments about what people, organizations, and governments should and should not do. As a complement to probabilistic thinking I propose that we need possibilistic thinking. In this paper I explicate the notion of possibilistic thinking. I first discuss the equation of probabilism with rationality in scholarly thought, followed by a section that shows the ubiquity of possibilis- tic thinking in everyday life. Demonstrating the latter will provide an opportunity to explore the limits of the probabilistic approach: that possibilistic thinking is widespread suggests it could be used more rigorously in social research. I will then address the most vexing prob- lem with advancing and employing possibilistic thinking: the prob- lem of infinite imagination. I argue that possibilism can be used with discipline, and that we can be smarter about responding to disasters by doing so.