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# EXPANDING THE ROKN'S CAPABILITIES TO DEAL WITH THE SLBM THREAT FROM NORTH KOREA

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*Sukjoon Yoon*

**T**he navies of both Koreas are capable of conducting effective underwater operations. The North Korean navy possesses more than seventy submarines that, while aging and relatively obsolete, remain difficult to detect. They are tasked mainly with disrupting South Korean sea lines of communication. The Republic of Korea (ROK) Navy (ROKN) enjoys European technological support and coordinates its operational tactics with the United States; the ROKN belatedly has deployed advanced littoral patrol submarine forces against the threat of North Korean submarines.<sup>1</sup>

Although earlier tests, presumably from a Sinp'o-class ballistic-missile submarine (SSB), were of debatable success, North Korea's test firing on August

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24, 2016, of an indigenous submarine-launched ballistic missile (SLBM), the KN-11, from a larger submarine, seems to represent a milestone.<sup>2</sup> This success has drawn greater attention to the balance of power between the two Korean navies.<sup>3</sup>

North Korea thus stands to become the sixth nation with SLBMs, joining the United States, the United Kingdom, China, Russia, and France. Such missiles provide a critical retaliatory (second-strike) capability, which is an effective deterrent against preemptive (first-strike) attacks. Nevertheless, serious doubts remain about the viability of North Korea's prototype SLBM and SSB

technologies and the extent to which its land-based missile technologies can be adapted to SLBMs without further innovations. Regardless, this development certainly poses a new challenge for the ROKN; its ally, the U.S. Navy; and the Japan Maritime Self-Defense Force (JMSDF). This challenge requires effective countermeasures using sea-based anti-air and anti-missile assets to enhance anti-submarine warfare (ASW) capabilities, as well as improved naval cooperation among the three navies to deter North Korean maritime threats, both conventional and nuclear.

Unfortunately, few good countermeasures are available to the ROKN, and the situation is complicated by a heated debate between those who believe that North Korean deployment of a full-fledged and effective SLBM capability is imminent and those who are not convinced that the three test launches during 2016 represent an urgent threat. In any case, it seems very likely that within a few years North Korea will deploy SSBs with some limited SLBM capacity. The ROKN needs to strengthen its readiness to respond to such North Korean missile and submarine threats, and must seek a way to secure strategic credibility for its deterrence posture.

This article considers the options open to the ROKN, in the context of its maritime cooperation with the U.S. Navy, to deal with these intractable North Korean SLBM threats. What is the best approach to take, and what types of naval assets can reduce the strategic ramifications of North Korean deployment of SLBMs? The only feasible option appears to be for the ROKN to improve its submarine forces, placing greater reliance on subsurface forces to provide strategic deterrence. This should keep North Korean SSBs at bay without incurring excessive reactions from North Korea or other regional states.

#### **NORTH KOREAN DEVELOPMENT OF SLBMS: ANOTHER RISKY STRATEGY**

North Korea seems determined to expand its nascent weapons of mass destruction (WMD) capabilities to the maritime domain around the Korea Peninsula. This is the most opaque of all war-fighting domains, and North Korea is deploying its underwater assets with WMD capability against the United States and South Korea, and even against China, if recent speculations are to be believed.<sup>4</sup> For North Korea, operating any class of submarines—whether conventional or of a more modern type, and whether large or small—represents an attractive new asymmetric strategic option.<sup>5</sup> This was proved by the sinking of the ROK ship (ROKS) *Cheonan* in 2010 by an indigenous North Korean midget submarine that launched a torpedo attack against the corvette in the West Sea (i.e., the Yellow Sea).<sup>6</sup>

North Korea claims that on May 8, 2015, just off the coast of the Korea Peninsula in the East Sea (i.e., the Sea of Japan), it successfully test fired an SLBM it calls Bukkeuksong-1.<sup>7</sup> South Korean analyses, drawing on U.S. defense intelligence agencies' resources, indicate the missile was launched by a Sinp'o-class SSB, which are declared by North Korea's *Nodong Sinmun* (*Worker's Paper*) to be "strategic submarines."<sup>8</sup> These vessels are sixty-six to sixty-eight meters in length, with a beam of 6.6 meters. The large conning tower is fitted with a single vertically mounted tube. North Korea has had access to several types and classes of submarines capable of operating as SSBs, through the use of either "Shaddock" tubes or a very large conning tower tube. These submarines were built by the Soviet Union at Komsomol'sk-na-Amure and Severodvinsk from 1958 until the mid-1960s (notably the Yankee/Golf classes) and by China at Dalian in 1964. The first Sinp'o-class SSB, a conventional ballistic-missile submarine, was built in November 2014 at Sinp'o shipyard. There is also some evidence of preliminary SLBM testing at that time.<sup>9</sup>

North Korean deployment of submarines carrying one to two ballistic missiles, each capable of delivering a miniaturized nuclear warhead, would be a very significant threat. Such vessels would be challenging to locate and track and would provide a mobile launch platform able to attack from any direction and at a significant distance from the Korea Peninsula. South Korean military analysts anticipate the North Korean navy will be ready to deploy a nine-meter SLBM with a range of two thousand kilometers within a few years.<sup>10</sup>

North Korea's decision to develop an indigenous SLBM capacity appears to be an extension of its nuclear brinkmanship strategy.<sup>11</sup> Acquiring a sea-based, second-strike nuclear option complements the nuclear weapons assumed to be deployed on land-based ballistic missiles. Two major motives underlie these policies: the North Korean regime is pursuing a blackmail strategy to demonstrate its "true nuclear power status," hoping thereby to attract more attention from the United States and perhaps from China; and Kim Jong Un is trying to establish himself as North Korea's absolute leader, building a personality cult to match those surrounding his father and grandfather.<sup>12</sup>

Kim has a two-pronged policy of simultaneous nuclear expansion and economic development, known as the "*byongjin* policy," but only the latter prong was declared a core political issue for the ruling North Korean Workers' Party's Seventh National People's Congress, which was held in May 2016, following an unexplained thirty-seven-year hiatus.<sup>13</sup> That Kim Jong Un's rule is yet to be consolidated fully is shown by the top-to-bottom purges of political and military leaders since the execution of his uncle, Jang Song Tak, in December 2013. Kim Jong Un is hoping to use the development of SLBM capacity to demonstrate his

vision for a new era, differentiating him from his late father, Kim Jong Il. Kim wants to be seen as improving living standards for the North Korean people, but also as building a strong North Korean nation, to which end he is striving to make it a genuine and acknowledged nuclear power. In this way he hopes to put pressure on the international community, including China, and also to bolster his personal support through North Korean patriotism and anti-Western sentiments.

Kim deliberately has gotten directly involved with the new SLBM system and also with the new ship-to-ship missile known as the KN-01. The latter is likely a reverse-engineered version of the Russian SS-N-6, launchable from either Sinp'o-class SSBs or surface platforms.<sup>14</sup> According to the official (North) Korea Central News Agency (KCNA), Kim observed the test firing of the surface-launched antiship missile on February 7 and of the SLBM on May 8, 2015. These events were meant to be viewed as a dramatic success, especially in comparison with the satellite launch that occurred in December 2012.<sup>15</sup> That launch was part of North Korea's efforts to develop an intercontinental ballistic missile (ICBM) capable of delivering a nuclear warhead to targets as far away as the continental United States. The ROKN and the U.S. Navy tracked the three-stage rocket from its boost phase to its midcourse phase over the Yellow Sea and recovered debris from the initial propulsion stage—to North Korea's humiliation.<sup>16</sup>

The two-pronged policy of developing nuclear weapons and the country's economy simultaneously seems likely to present grave problems for North Korea, which experienced a severe drought in 2014–15 and is likely to face a serious shortage of food and a variety of social problems. These will be exacerbated by a reduction in aid from China and probably Russia and by sanctions over nuclear and missile development by South Korea, the United States, and Japan. With the basic incompatibility of the two prongs becoming obvious, North Korea is seeking a way out of its dilemma by attempting to terrorize the United States and South Korea. This new threat, of a second-strike nuclear capability, represents a potent counter to the possibility of surgical military operations by the United States and to proactive tactics against North Korean military provocations by South Korea. Majority opinion perceives this scenario as a strategic nightmare, although some have argued that it actually stabilizes the situation, since North Korea no longer needs to rely on preemptive attack or a launch-on-warning policy.<sup>17</sup>

A further ratcheting up of tensions came on January 6, 2016, with a fourth North Korean nuclear test. KCNA claimed the test was of a hydrogen bomb, but this is generally disputed. On February 7, 2016, North Korea conducted its fourth satellite launch via long-range ballistic missile.<sup>18</sup> The private, U.S.-based research institute 38 North also has reported that the North Korean Sohae satellite launching station has been upgraded by construction of fuel-storage bunkers; it argues

that this indicates that the launch of a fifth North Korean long-range rocket, presumably another ICBM test, is upcoming.<sup>19</sup>

In summary, Pyongyang seems committed to grabbing the attention of Seoul, Washington, and Beijing by continuing to pursue a policy of nuclear blackmail to force their recognition of North Korea as a true nuclear power—which is central to Kim Jong Un's consolidation of power.

#### TECHNICAL AND OPERATIONAL ISSUES FOR NORTH KOREA'S DEVELOPMENT OF SLBMS AND SSBS

The true extent of North Korean capabilities remains unclear, and observers' skepticism abounds.<sup>20</sup> Even in the absence of credible evidence that North Korea is capable of launching any SLBM, let alone a nuclear one, and from a true SSB, the apparent test firing of its first SLBM could be a game changer that disrupts the balance of naval power between the two Koreas.<sup>21</sup> This view has dominated press coverage in South Korea.<sup>22</sup> If North Korea's new capability is confirmed, its sea-based nuclear-power status could strengthen significantly the strategic credibility of the country's nuclear deterrence posture toward the United States and, by extension, toward South Korea.

For the near term, however, the SLBM test firing of May 2015 may well impose some strategic costs on Kim Jong Un's regime. For instance, the North Korean pursuit of an SLBM capacity is in clear violation of four UN Security Council (UNSC) resolutions condemning North Korea's nuclear and missile proliferation: Resolution 1718 (2006), Resolution 1874 (2009), Resolution 2087 (2013), and Resolution 2094 (2013).<sup>23</sup> It also caused South Korean president Park Geun Hye to take a firmer line with the North, since her most significant diplomatic accomplishment was her strong working relationship with China, on the basis of which she offered the North the prospect of a "unification bonanza," conditional on military restraint.<sup>24</sup> President Park's insistence was clear during the North-South dialogues held in November 2015: "Unless you demonstrate your commitment to denuclearization, you will get nothing from the South: you should be convinced of this fact."<sup>25</sup> President Park's subtle diplomatic maneuvering, intended to influence China's attitude toward the two Koreas, can be seen in her courageous participation in the 2015 China Victory Day Parade, a distinctly military occasion, despite strong objections from Washington and Tokyo.<sup>26</sup>

Indeed, following the latest round of sanctions imposed by UNSC Resolution 2270 following North Korea's January 6, 2016, fourth nuclear test, President Park insisted that the North abandon its nuclear ambitions entirely: "[D]espite North Korea's continuous saber rattling through nuclear and missile tests and its defiance of UNSC resolutions, any future provocations will be met with robust retribution."<sup>27</sup> The security situation on the Korea Peninsula has deteriorated further

since the latest sanctions, with North Korea repeatedly firing short- and medium-range missiles and also broadcasting video mock-ups of military landings and preemptive drills targeting South Korea's capital and U.S. cities.<sup>28</sup> Meanwhile, U.S. president Barack Obama's policy of "strategic patience" has given North Korea scant room to maneuver, despite the United States becoming more accommodating toward Cuba and Iran. More seriously, from Kim Jong Un's perspective, China has become a less reliable ally for North Korea, with ideological ties being given less weight than before.<sup>29</sup>

Various commercial satellite images indicate, and some military and private intelligence agencies monitoring North Korean SLBM and SSB development suggest, that the North Koreans are encountering some serious technical difficulties: they are using liquid propellant rather than the superior solid variety, as shown by a distinct lack of white smoke in images; and there are problems with the condensed air propulsion to eject the SLBM above the water's surface, as evidenced by the use of a vertical launch tube to push the missile out of the conning tower. Further problems arise from the need to adapt to the length and beam of the available SSBs, which are rather too small to accommodate the SLBMs' "plug-in/plug-out" design. North Korea's SSB is apparently the product of reverse engineering 1970s vessels built by Russia and China.<sup>30</sup> The London-based *IHS Jane's Defence Weekly* analyzes the North Korean KN-11 SLBM as being similar to the Soviet R-27 Zyb / SS-N-6 Serb SLBM; North Korea is known to have acquired some of these missiles in 2003.<sup>31</sup>

It also has been reported that on November 28 and December 12, 2015, attempted follow-on test firings of KN-11 SLBMs from Sinp'o-class SSBs resulted in failure, so perhaps North Korea's Sinp'o-class SSB will remain nothing more than an impractical prototype, similar to those of Russia and China during the 1960s.<sup>32</sup> Furthermore, even if SLBMs can be launched reliably, a great deal more would be involved before the North Koreans could establish a submarine-based second-strike nuclear attack capability, and they are very far from achieving the operational capabilities and technological innovations required for the continuous at-sea deterrent nuclear capability that other powers maintain. Indeed, South Korean analyses suggest that North Korea may acquire just a single prototype of the Sinp'o-class SSB, with a single vertical launch tube for SLBMs.<sup>33</sup>

In summation, U.S.-ROK combined military intelligence agency analyses conclude that this submarine was built at the Sinp'o shipyard, on the basis of 1960s technologies, by reverse engineering Golf-class SSBs acquired from the Soviet Union; that it can carry a maximum of three KN-11 SLBMs; and that it would be incapable of operating as a far-sea strategic nuclear deterrent without significantly enhanced far-sea command-and-control systems and capacities.<sup>34</sup> Russia and China have preferred to deploy their SSBs and SSBNs in a near-sea

environment—the so-called bastion strategy, whereby nations with a continentally oriented naval strategy, lacking sufficient deep-sea control, seek to maximize the chances of operating an effective second-strike capability.<sup>35</sup> It therefore seems impossible that North Korea could deploy its SSBs for far-sea strategic-deterrent patrol operations, since this would require surface combatant task units centered on aircraft carriers.

Even if North Korea succeeds in building indigenous SSBs by copying Russian and Chinese models, ejecting an SLBM from a vertical launch tube through the large conning tower of the Sinp'o-class SSB remains a formidable challenge. *The Washington Free Beacon*, an online news site, reported on December 10, 2015, that a Sinp'o-class SSB had been damaged after it failed to eject a KN-11 SLBM (or perhaps a submarine-launched cruise missile [SLCM]) properly off the coast of Wonsan in North Korea.<sup>36</sup> If this U.S.-originating report is correct, the failure represents a serious setback for North Korea's SLBM and SSB program.<sup>37</sup>

Those with a skeptical view of North Korea's progress can point to the small size of the Sinp'o-class SSB, which seems inadequate for SLBM launching. A South Korean think tank has argued that the SLBM test firing was completely fabricated to support Kim Jong Un's pretensions to lead a true nuclear power and to bolster the personality cult of the Kim family.<sup>38</sup> Since the KN-11 SLBM's length is nine meters, the Sinp'o-class SSB's length appears too small, unless North Korea has redesigned the submarine; and since the KN-11 SLBM has a range of less than two thousand kilometers, the Sinp'o-class SSB is not capable of carrying out an attack on the continental United States, for which a much larger vessel (of more than three thousand tons) would be required.<sup>39</sup> Moreover, analysis of the recovered debris from the first stages of North Korean rockets launched in December 2012 and February 2016 has revealed that North Korea lacks the materials and the fabrication skills that other navies with SLBM capability employ.<sup>40</sup> China's *Global Times* revealed that, surprisingly, the main body of the KN-11 SLBM appears to be made of reinforced glass fiber rather than the carbon fiber usual for modern, advanced missiles.<sup>41</sup> Chinese military analysts also have argued that North Korea appears to lack confidence in its preliminary SLBM trials: apparently it conducted ejection tests using a stationary submersible platform.<sup>42</sup>

Such doubts about North Korean capabilities have been partially resolved by photographs and video footage released by KCNA of the three launches on April 23, July 9, and August 24, 2016.<sup>43</sup> One day after the latest test, North Korea's state-run website *Uriminzokkiri* claimed a fully successful flight test of an SLBM following the earlier ejection tests. The missile was fired at a very steep angle and flew about five hundred kilometers (311 miles) toward Japan, falling into the East Sea within Japan's air defense identification zone; had it been fired at a shallower angle, it could have flown more than a thousand kilometers. The U.S.



and South Korean militaries report that the 2016 tests were probably powered by solid rather than liquid propellant, and also confirm that they were launched from below the surface of the water, presumably by compressed gas, judging by the narrow translucent exhaust plumes; this cold-launch technology represents a significant milestone. Some video images of the loading and launch appear to show a larger submarine than the Sinp'ŏ-class SSB used for the previous tests;<sup>44</sup> it seems that this latest test was conducted from a new type of SSB, of the Gorae class (after the Korean word for dolphin), displacing approximately two thousand tons and equipped with a vertical launch tube.<sup>45</sup> Both the Sinp'ŏ and Gorae classes have limited endurance and missile-carrying capabilities, however, and South Korean analysts have speculated that the Gorae class is an experimental prototype intended to pave the way for larger SSBs with better endurance, which may well be nuclear powered.<sup>46</sup>

This demonstration of several important SLBM technologies, including underwater ejection and initial attitude control and an improved underwater platform, lends weight to the fear that North Korean SLBM capabilities could mature much more quickly than previously believed.

## IMPLICATIONS OF NORTH KOREAN SLBMS FOR SOUTH KOREA AND ITS NEIGHBORS

There are two distinct schools of thought about the viability of North Korea's capacity to operate its KN-11 SLBM system. Opinions differ on the progress North Korea has made toward the miniaturization of nuclear warheads for long-range delivery, the authenticity of its SLBM test firings, and the feasibility of deploying full-fledged SSBs in the East Sea.

### *The Optimists*

Some see little immediate cause for concern, arguing that North Korea's missile-related technologies and systems for submarine-launched and long-range missile strikes are insufficient.<sup>47</sup> They also cite its lack of far-seas operational experience and proficiency, the inadequacy of Russian and Chinese Golf-class SSBs, and the weakness of the Sinp'ŏ naval base where the SSBs are constructed—satellite imagery shows the base has a simple flat-top design, in contrast to the complex zigzag features of Russian and Chinese naval bases, implying a lack of sophistication in the comparable Sinp'ŏ facilities. Rumors abound that during the mid-1990s North Korea purchased Chinese and Russian Golf-class SSBs as scrap, using them as the Chinese navy did in developing its first-ever aircraft carrier in 1997 from a Russian vessel.<sup>48</sup> Such views mainly come from U.S. and South Korean defense experts, who believe that North Korea would need considerable time and effort before it could deploy SSBs with SLBM capability to conduct true

strategic-deterrence patrol missions, and that doing so would require clandestine technical support from both China and Russia.<sup>49</sup>

### *The Pessimists*

In contrast, many serving and former naval officers are very worried about North Korean progress in operating SSBs with SLBM capabilities. They cite North Korea's secretive technological collaboration with China and Russia on ballistic missiles and submarines; its long experience in developing land-based, three-stage ballistic missiles under the pretext of launching commercial satellites; and the many circumstantial indications that it has miniaturized its nuclear warheads successfully. The recent ceremonial military parade in Pyongyang provided especially noteworthy evidence:<sup>50</sup> display of a modified version of the liquid-fueled KN-08 ICBM, apparently with a small nuclear warhead. The KN-11 SLBM appears to be a new version of the KN-08.<sup>51</sup> These naval officers also mention recurring evidence of land-based tests of a submarine ejector system using vertical launch tubes, conducted at an island off Sinp'o.

### *Common Concerns: South Korea, Its Neighbors, and Its Allies*

Both sides agree, however, that the North Korean test firing used an SLBM, not an SLCM; that problems remain with miniaturizing nuclear warheads and with developing missile-ejection technology; and that North Korea intends to acquire SLBM capability with WMD warheads, whatever the costs and consequences. It is therefore just a matter of time before North Korea deploys indigenous KN-11 SLBMs in Sinp'o/Gorae-class SSBs. However, in addition to this SLBM threat, some South Korean naval and security experts argue that North Korea may be able to develop SLCMs as well. In October 2015, the Russian Project 636.3 Kilo-class diesel-electric submarine (SSK) *Rostov-na-Donu* fired multiple Kalibr (3M-14) SLCMs through its torpedo tubes, from the Caspian Sea into Syria's Ar Raqqa province. Many lesser naval powers have acquired Kilo submarines, and North Korea may be intending to make use of the Russian SLCM experience and technologies.<sup>52</sup> Kalibr SLCMs carry a five-hundred-kilogram warhead, have a range of two thousand kilometers, and are accurate within a few meters.<sup>53</sup>

The two sides differ on the timescale of when North Korea will be able to deploy indigenous SLBMs carried by Sinp'o/Gorae-class SSBs, with the pessimists anticipating sometime in 2017 as the earliest this might occur.<sup>54</sup> If such views prove correct, this would be a grave concern for South Korea and other countries in the region, as well as for the United States.<sup>55</sup> Military experts and security analysts from both sides of this debate, in Seoul and in Washington, were caught out by North Korea's development of an SLBM capability, which further increases the threat its weapons of mass destruction pose.<sup>56</sup> It is certainly true that missiles launched from underwater assets are more difficult to detect and intercept than

land-based ones, and as North Korea's SLBM capabilities expand into the deep seas this problem will become more serious, threatening South Korea, Japan, and U.S. bases in Northeast Asia, and also complicating U.S.-led theater missile-defense planning. The wider regional character of North Korea's agenda is clear to the military establishments in Seoul and Washington.<sup>57</sup>

These developments also affect South Korean plans for an indigenous missile-defense system intended to guard against potential missile attacks from both China and North Korea.<sup>58</sup> South Korea's National Security Committee considers that North Korean SSBs carrying land-attack missiles would complicate regional missile-defense planning seriously, since the system under development and due for completion by 2020, known as the Korea Air and Missile Defense (KAMD), only targets North Korean aircraft.<sup>59</sup> Therefore the ROK Ministry of National Defense (MND) is attempting to change the conceptual framework of KAMD from a proactive defense posture to a preemptive one. North Korean SLBMs would be targeted in ports capable of harboring SSBs.

Accomplishing this likely would require U.S. cooperation to enhance KAMD's competency. Moreover, bilateral negotiations are taking place between the U.S. Department of Defense and the ROK MND about deploying the Terminal High Altitude Area Defense (THAAD) system on South Korean soil, although the U.S. Army would operate it; however, the results of the recent election in South Korea have cast doubt on the political feasibility of this deployment.<sup>60</sup> The Japanese defense minister also recently referred to this issue publicly for the first time, in the context of protecting Japanese and U.S. forces in Japan.<sup>61</sup> On June 28, 2016, the U.S. Navy, the JMSDF, and the ROKN conducted their first joint missile-tracking naval exercise, code-named PACIFIC DRAGON, off the coast of Hawaii, on the sidelines of the Rim of the Pacific exercise (known as RIMPAC). PACIFIC DRAGON focused on improving tactical and technical coordination among the three navies. It included live ballistic target tracking, with each navy's Aegis ballistic-missile defense (BMD) system sharing tactical data.<sup>62</sup>

### *North Korea and China*

Even China has expressed serious concerns about North Korea's third SLBM launch, on August 24, 2016, and its fifth nuclear test, on September 9, 2016, and has criticized North Korea's claim to be a nuclear-armed state.<sup>63</sup> In light of the WMD threats from North Korea, Chinese president Xi Jinping's ambitious but ambiguous "True Maritime Power" initiative may be impacted, with China's neighbors wondering who is responsible for North Korea's brinkmanship strategy and perhaps also having second thoughts about participating in China's "One Belt, One Road" initiative, given the prospect of wider geopolitical fallout.<sup>64</sup> North Korea also fears President Xi's ambitious plans to establish a "New Type of

Great-Power Relations” with the United States. China is distracted further by territorial disputes in the East and South China Seas. Indeed, there is some evidence of a shift in Chinese policy toward North Korea, especially China’s collaboration with the United States and Japan to pass stricter sanctions, via UNSC Resolution 2270, in response to North Korea’s nuclear and ICBM tests in January and February 2016.<sup>65</sup> Despite Xi Jinping’s apparent endorsement of Kim Jong Un in a formal letter in October 2015, the Chinese are surely aware of the geopolitical and strategic implications of North Korea’s latest nuclear test, on September 9, 2016.<sup>66</sup>

The growing disharmony between China and North Korea has been manifest even in the dimension of popular culture: a five-day Chinese tour by the all-female North Korean musical group Moranbong in December 2015 was called off suddenly—just three hours before the first performance. Sources from the Chinese Communist Party attributed this to “communication issues at the working level” with the North Korean Workers’ Party, although it is rumored that this debacle may have been China’s response to Kim Jong Un’s hints about developing a hydrogen bomb.<sup>67</sup>

In general, China seems less inclined to provide the political and economic commitment that North Korea desires; yet Chinese supplies of cash, food, arms, and energy remain crucial for North Korea. With China proving less tractable, it is no longer unreasonable to suppose that an impoverished North Korea may be trying to exert pressure on Beijing, as well as on Washington and Tokyo. Hence the continued nuclear brinkmanship as a strategy intended to overcome such external difficulties.<sup>68</sup>

Yet, although the Chinese are scrambling to avoid being blamed for North Korea’s disruptive behavior, they are unlikely to go beyond the stern words already uttered; it probably will be business as usual, with China doing the minimum to ensure North Korean survival and to avoid the threat of North Korean collapse, which for China would be an even worse outcome than the status quo.

A Chinese monthly magazine dealing with naval matters has referred openly to the fact that China considers the proliferation of various types of submarine operations in the East Sea to be a serious problem. China is concerned that North Korea could create sanctuaries within the East Sea where its low-value SLBM submarines could operate within a “bastion,” emulating the classic Soviet and Chinese strategy.<sup>69</sup> China is worried that this would convert the East Sea into an operational theater for Western submarines, disrupting Chinese plans to use it as a sea route for supplying bituminous coal from three poor northern Chinese provinces to the country’s prosperous eastern cities. Another problem for China is that North Korean SLBMs might prompt the ROK to set aside its long-standing complaints about Japan’s historical transgressions to forge a closer trilateral

military alliance with Japan and the United States—something China has worked hard to prevent.<sup>70</sup>

China doubts the plausibility of North Korea's modification of the Sinp'ò/Gorae-class SSB to carry and launch its indigenous ballistic missiles. But, beyond the possibility of North Korea actually operating SLBMs, China seems upset by North Korean grandstanding in the East Sea in general.<sup>71</sup> The Chinese understand that SLBM submarines would need extensive protection from other naval forces to respond rapidly to hostile forces seeking to restrain the SLBM submarines in confined seas. The prospect of a North Korean deployment of Sinp'ò/Gorae-class SSBs in the East Sea drawing more attention from the ASW forces of the ROKN, the U.S. Navy, and the JMSDF is most unwelcome to the Chinese military, especially if such scrutiny extends into the West Sea—a very sensitive area for the Chinese People's Liberation Army Navy, which bases its North Sea Fleet at Qingdao.<sup>72</sup>

Although North Korea's rhetoric remains focused on the United States, alarm bells are beginning to ring for China as North Korean WMD threats become reality.

The KN-11 SLBM clearly represents an advance toward building a genuine SLBM capability, one that North Korea is intent on developing. Recently North Korea implicitly claimed a successful test (though not a flight test) of a new ICBM engine that would enable it to strike the North American continent with a miniaturized nuclear warhead. Several steps remain before North Korea could realize its ICBM aspirations, but there have been indications of some progress in miniaturizing nuclear warheads; in testing reentry technology to allow an ICBM to return through Earth's atmosphere without breaking up; and in building a solid-fuel rocket engine, which expedites launch preparation.<sup>73</sup> North Korea has vowed to expand its nuclear and missile programs in defiance of the latest round of tougher UNSC sanctions imposed in March 2016.

It would be a serious mistake for the United States to overlook the gravity of the nuclear threat that North Korea represents; this issue will remain near the top of the U.S. national security agenda.<sup>74</sup>

#### THE ROKN'S REQUIREMENTS OF OPERATION: A PREEMPTIVE ANTI-EXIT STRATEGY

If the worst-case scenario materializes—North Korea technically and operationally perfects its SLBM capabilities and miniaturizes its nuclear warheads for long-range delivery (it is believed to have stockpiled six to eight nuclear warheads)—the ROKN certainly will need to carry out a wholesale revision of its concepts of naval warfare.<sup>75</sup> It should continue to deter North Korean maritime subsurface

threats through its existing littoral ASW and anti-air warfare (AAW) approaches, but also must develop new capabilities for submarine deterrence patrols and anti-exit operations, as well as intensive air and surface ASW operations, sea-based special operations, theater missile defense, and enhanced antisurface warfare (ASUW).

It has been reported that after observing the North Korean SLBM test firing, President Park Geun Hye immediately ordered the ROK MND to develop appropriate preemptive measures, focusing especially on sophisticated underwater assets and indigenous air- and missile-defense capabilities.<sup>76</sup> The initial emphasis is on countering North Korean SLBM threats through an innovative military doctrine, called the “4D military posture” for *defend, detect, disrupt, and destroy*.<sup>77</sup>

But it is also essential to establish new operational countermeasures. While the operational abilities of North Korean SLBMs remain unproven and the specifications of the Sinp’o/Gorae-class SSBs are still mysterious, the ROKN should deter North Korean submarine and WMD threats by a well-defined preemptive anti-exit strategy that entails sustainable long-duration submarine operations beyond the South Korean area of operations (AOR). To accomplish this, the ROK MND is planning an “underwater KAMD system.” Detection will employ military-intelligence surveillance satellites and strategic, high-altitude, unmanned aerial vehicles to monitor North Korean Sinp’o/Gorae-class SSBs berthed at their naval base; tracking will be done by dispatching Aegis-equipped ROKN destroyers and frigates to the scene; and destruction will rely on intercepting SLBMs with anti-air missiles such as SM-2s launched from surface combatant ships.<sup>78</sup>

The ROK MND recently published a five-year defense improvement plan, which proposes supplementing the limited ability of the current Aegis air-defense system by developing an indigenous theater ballistic-missile defense function or an air/missile defense capability.<sup>79</sup> The ROKN is known to have wanted to implement a limited sea-based BMD system for the existing Aegis-equipped KDX-III destroyers with the SM-6 missiles under development, but this BMD was considered inadequate for the ROKN’s long-term requirements, and the project was derailed by political difficulties during the liberal administration of the late president Roh Moo Hyun. The ROKN’s next three *King Sejong the Great*-class KDX-IIIs will be equipped with the Aegis Baseline 9 naval combat system that features an integrated air- and missile-defense capability, including Lockheed Martin’s SPY-1 multifunctional radar system. The ships will be constructed by South Korean shipbuilder Hyundai Heavy Industries and are expected to come into service in 2020, 2021, and 2022.<sup>80</sup>

Both the SM-6 and the SM-3 were developed for the U.S. Navy for either land- or sea-based missile defense. The SM-6 has only a limited capability as a missile interceptor, so the U.S. Navy relies primarily on the SM-3; but this is a

very expensive option for intercepting North Korean ICBMs, especially when the latter's ability to carry nuclear warheads is still in doubt.<sup>81</sup> The U.S. Navy and the JMSDF collaborated on the development and deployment of the SM-3, but the ROKN so far has not used this missile on its *King Sejong the Great*-class KDX-III destroyers. Having chosen to stay outside the U.S.-led BMD architecture intended to counter regional WMD threats, the ROK is faced with a difficult decision. The indigenous KAMD system, even if bolstered by U.S. assistance, will offer only a brief window of defense against the short-range ballistic missile threat from North Korea, and both the ROK and its ally, the United States, remain in the crosshairs of North Korean SLBMs. ROKN acquisition of SM-3s to counter such WMD threats is not an absurd idea, but it would be extremely expensive to accomplish.<sup>82</sup>

North Korea's SLBM aspirations have provoked operational and tactical turmoil in the ROKN. If it is not feasible to acquire SM-3s or SM-6s to function as interceptors as part of an underwater KAMD system, there is an urgent need to enhance far-seas ASW operational capability. The ROKN still is operating its obsolete P-3C Orions for littoral ASW missions, and has yet to secure defense budget allocations to acquire replacements. Many naval experts have proposed acquiring P-8 Poseidon far-seas maritime security surveillance aircraft to support the ROKN's underwater KAMD system and to enhance its ASW operational capabilities.<sup>83</sup> The Poseidon is the world's most capable maritime patrol aircraft, with a state-of-the-art networked ASW system; next-generation sensors, such as fourth-level, low-frequency, active sonar; and reliable, high-efficiency turbofan engines. ROKN acquisition of the P-8 would allow greater interoperability with the U.S. Navy and the JMSDF, which are already operating these aircraft throughout the Indo-Asian-Pacific region, and would enhance greatly the ROKN's ASW abilities to detect North Korean underwater assets.<sup>84</sup>

It is essential for the ROKN to establish a robust and rigorous new concept of submarine-based ASW to exploit the technical and functional vulnerabilities of the North Korean SLBMs and SSBs so as to contain them within the bay of Sinp'ò. This will require two major operational changes: increasing the capacity for preemptive submarine operations and extending the operational areas beyond their present limits. Despite the ROKN's substantial experience with ASW in its East Sea AOR, it will not be an easy task to detect SSBs in such a cluttered and noisy body of water and then to destroy them in the face of North Korean antisubmarine operations.

Conducting preemptive anti-exit strikes on North Korean naval bases under the concept of the underwater KAMD doctrine will require changes to several aspects of current South Korean practice: expanding the AORs, revising rules

of engagement (ROEs), and deploying ROKN submarine forces in the near sea around the Sinp'o naval facility. Under the current rather basic guidelines of defense-oriented ROEs, which regulate how to fight against North Korean military provocations, the ROKN would have very limited options in deploying its far-seas ASW assets to deter North Korean SLBMs preemptively beyond the existing AOR. Open publications from the ROKN and ROK MND explicitly mention how the ROKN AORs are limited by the northern limit line (NLL) and indicate that this prevents the ROKN from conducting an effective preemptive anti-exit strategy.<sup>85</sup>

In this regard, urgent negotiations with the United States also are needed to implement a *conditional* wartime transfer of operational control to the ROKN. One of the top priorities of an ROK-led wartime operational plan is the expansion of the ROK's AORs to deter North Korean WMD threats that currently are being allowed to develop in the shelter of the NLL and the Demilitarized Zone. Relatively silent SSBs with a low acoustic signature provide very little indication of their presence and can launch SLBMs without warning. In the complex and noisy underwater domain of the East Sea, such vessels, once submerged in deep seas, are very hard to detect, presenting a serious challenge to South Korea's national security.<sup>86</sup>

The ROKN therefore needs to move beyond its current littoral ASW operations, mostly conducted by surface combatant platforms in the existing limited AOR. Two constraints severely hamper these operations: the armistice agreement between the North Korean military and the UN Command, and the prevailing operational plans under the guidelines of the ROK-U.S. Combined Forces Command, established in 1978. Under the current defense-oriented naval doctrine, the ROKN is exercising only very limited littoral ASW capabilities, targeting the aging North Korean Romeo-class submarines and midget submarines. All ROKN platforms operate within the currently designated AORs: the East Sea, and south of the NLL in the West Sea. The emerging threat from North Korean Sinp'o/Gorae-class SSBs makes an early expansion of the limited South Korean AORs essential.

Under the current implementation of the ROEs, according to the armistice agreement, the ROKN can deploy no preemptive assets into North Korean waters, so it is not possible to deploy submarine forces to detect North Korean SSBs or to conduct comprehensive far-seas ASW operations against North Korean SSB patrols.<sup>87</sup> To meet the newly formulated ROK MND 4D military doctrine, the ROKN's operational capacity in the East Sea needs to be expanded significantly within the next few years.<sup>88</sup> Preemptive anti-exit operations in the underwater domain will require larger underwater assets capable of sustaining long-duration



missions.<sup>89</sup> The 4D military posture also will require technological advances to detect, track, and attack the Sinp'o/Gorae-class SSBs in today's increasingly cluttered and noisy maritime environment.<sup>90</sup>

The ROKN has concentrated mainly on AAW and ASUW, with littoral ASW capabilities being essentially self-defensive. The kinds of mission so far prioritized are represented by the ROKN's acquisition of *Gwanggaeto the Great*-class KDX-I, KDX-II (a.k.a. *Yi Sun Shin*-class KDX-II), and KDX-III (a.k.a. *King Sejong the Great*-class KDX-III) destroyers; *Ulsan*-class FFX frigates; and *Chang Bogo*-class KSS-I and KSS-II (a.k.a. *Sohn Won Il*-class KSS-II) submarines.<sup>91</sup> With the advent of North Korean SSBs, however, surface vessels are clearly vulnerable to attack unless the ROKN has the resources to conduct intensive ASW operations. The ROKN is operating an organic ASW air asset, the P-3C Orion, and would benefit greatly from establishing an underwater sound-tracking system in the sensitive seas by integrating the ASW resources of friendly navies. In addition, with the prospect of a near-term North Korean deployment of its SSBs carrying SLBMs in deep-sea domains of the East Sea, the most opaque of all war-fighting theaters, the ROKN is urging more sustained development of its underwater firepower with better and more capable sensors and weapons.<sup>92</sup> Its next-generation submarines, the *Chang Bogo*-class KSS-IIIs, and the *Gwanggaeto*-class KDX-III destroyers are expected to have a long-range, land-strike capability, using indigenous long-range cruise missiles, code-named Haesong-III, with a range of more than a thousand kilometers.<sup>93</sup>

## ROKN OPTIONS

How can the ROKN implement a preemptive anti-exit strategy in the underwater domains to counter North Korea's SLBM-oriented nuclear brinkmanship strategy? It needs to acquire strategic ASW platforms to facilitate comprehensive ASW operations and enhance its ability to contribute to joint or combined ASW operations with the U.S. Navy and the JMSDF. This will send a strong signal to North Korea that its plan to operate its SLBM submarines by emulating the Soviet or Chinese bastion strategy will be riskier than expected. The essential requirement is to bottle up North Korean SLBM submarines and hunt them down in confined waters, thus effectively countering the North Korean bastion strategy.<sup>94</sup>

As to the specifics, there are several options for the ROKN to enhance its comprehensive ASW capabilities: purchase P-8s, build an ASW-oriented aircraft carrier (CV), or build nuclear-powered submarines (SSNs).<sup>95</sup>

### *Submarines*

Some important work is already in progress: the ROKN's submarine force command, established in mid-2015, has demonstrated its effectiveness quickly; and on January 4, 2016, the ROKN set up a task force to design and configure the first

batch of *Chang Bogo*-class KSS-III submarines. The project's defense industrial partner is Daewoo Shipbuilding & Marine Engineering, which has demonstrated its capacity for first-in-class construction with the *Chang Bogo*-class KSS-I/II, with the KSS-I being constructed under license and the KSS-II using indigenous technologies and designs.

Unofficial sources contacted by the Seoul Broadcasting System have revealed that a decision on the propulsion system for the second and third batches of the *Chang Bogo*-class KSS-III submarines has yet to be made. It seems not unlikely, then, that the air-independent propulsion mode of the first batch may be replaced by an indigenous nuclear propulsion system for the subsequent batches.<sup>96</sup> It also has been reported that the ROKN plans to build a total of nine *Chang Bogo*-class KSS-III submarines between 2027 and 2043; these will have a three-thousand-ton displacement and be equipped with vertical missile launchers.<sup>97</sup> The Sohn Won Il Forum (the Korea Institute for Maritime Strategy mechanism for discussing maritime security issues) has recommended that the subsequent batches be capable of long-endurance underwater operations (preferably 50 percent longer than *Sinp'o*/*Gorae*-class SSBs), high speed, and improved maneuverability at various depths in the complex underwater spaces around the Korea Peninsula.<sup>98</sup> Nuclear power plants using highly enriched uranium fuel may be the best option, although they would be limited to less than 20 percent enrichment to meet the ROK-U.S. nuclear agreement signed when the ROK abandoned its secret nuclear weapons program during the 1970s.<sup>99</sup>

### *Carriers*

The ROKN has been negotiating with the ROK MND and joint chiefs of staff about acquiring a next-generation *Dokdo*-class batch 2 landing helicopter dock (LHD). An ASW-oriented aircraft carrier would be invaluable for integrating a wide variety of naval component operations in the open seas, including comprehensive ASW operations in the surface, air, and underwater domains to counter the proliferation of conventionally powered quiet submarines capable of extended submerged operation.<sup>100</sup>

An ASW-oriented CV of this kind would provide the ROKN with many benefits: advanced, long-range, underwater, high-/low-frequency sound sensors; air and surface tactical ASW data integration at the theater level; close operational coordination by a dedicated shipborne ASW commander; and active ASW weapons, including heavy torpedoes. An ASW CV, by providing firm sea control, also would provide the SSNs already discussed with greater survivability and sustainability in conducting long-duration, deep-sea deterrent patrols. A very capable ASW CV thus would be able to implement the necessary preemptive anti-exit strategy. Such a highly integrated surface platform could deliver far-seas ASW

functionality beyond the current AORs and adopt more-active ROEs to detect, identify, and attack North Korean SSBs.

In addition to ASW, the ROKN CV could coordinate many related functions: dispatching special operations forces; using attached submerged vehicles; and launching long-range, land-attack cruise missiles.

### *Choices, Combinations, and Collaboration*

Nuclear-powered submarines can operate in deep waters, and can both chase enemy submarines and elude torpedo attacks on themselves. Fast and stealthy SSNs are an offensive asset, capable of conducting submarine-to-submarine operations and land-attack warfare. South Korean SSNs could prevent North Korean SLBM submarines from operating in distant seas, obliging them to stay close to shore. Whether the ROKN will be able to build an indigenous ASW CV or SSNs or both in the near future is uncertain; but, if it becomes necessary to choose among ASW assets, SSNs are probably the best option.

In addition to the capabilities mentioned above, SSNs can detect unknown submarines acoustically, but this is not easy; only an ASW-oriented naval task force will be able to conduct effective ASW operations in the complicated underwater environment around the Korea Peninsula, in which sound distortion is commonplace. Even with SSNs, the ROKN's offensive capabilities would remain very limited, so ROKN SSNs would have to be capable of supporting a USN CV strike group, which would include assets able to project power inland from the littoral, such as a USN *Zumwalt*-class destroyer designed for land-attack missions. The ROKN still would lack underwater assets for far-seas operations.<sup>101</sup>

What models are available for an ROKN ASW CV? The Royal Australian Navy's *Canberra*-class LHD is an interesting example. Austal USA produced a trimaran littoral combat ship for the U.S. Navy, and the same company has suggested a trimaran CV capable of carrying many unmanned aerial combat vehicles.<sup>102</sup> If North Korea succeeds in deploying a submarine force with an SLBM capacity, a CV-based organic ASW air wing capacity would provide an effective deterrent. An ROKN ASW CV should not be regarded primarily as an offensive naval platform, but essentially as a defensive asset intended to deny access to any potential adversaries' underwater assets in the near seas of the Korea Peninsula.

Another issue concerns U.S. plans to redeploy more than 60 percent of its naval combatants to Asia by 2020. According to the recently revised "Cooperative Strategy for 21st Century Seapower," now subtitled "Forward, Engaged, Ready," the U.S. Navy's current and upcoming budget submissions will provide for a fleet of more than three hundred ships and a forward presence of about 120 ships by 2020, the latter up from an average of ninety-seven in 2014. The strategy includes a statement that "[t]he centerpieces of naval capability remain the Carrier Strike Group and Amphibious Ready Group. . . . These ships, aircraft, Sailors,

and Marines have deterred and defeated aggression since World War II and will continue to do so well into the future.<sup>103</sup> However, as China seeks to become a true maritime power and disputes in the East and South China Seas grow hotter, the U.S. Seventh Fleet may be drawn away from Korean waters in the near future.

Therefore the ROKN may have to take responsibility for preserving maritime security around the Korea Peninsula and for handling North Korean maritime threats. An ASW CV and SSNs would be immensely helpful for fulfilling this enhanced role. USN cruisers and destroyers assigned to monitor, track, and intercept North Korean WMD threats currently have insufficient air wing ASW assets and underwater platforms to conduct effective ASW operations, so it is only sensible for the ROKN to provide complementarity. The ROKN needs hybrid assets capable of both defensive and offensive naval operations. By building an indigenous ASW CV and SSNs, the ROKN can satisfy both strategic aims in a rapidly changing maritime security environment that presents several pressing challenges.

This article has summarized the political and operational contexts within which North Korea's latest acts of nuclear blackmail—its flight test of an SLBM on August 24, 2016, and its fifth nuclear test, on September 9, 2016—should be understood. Its analysis of the KN-11 SLBM and the Sinp'o/Gorae-class SSB has been based on official South Korean (especially MND), U.S., and other sources, including from the United Kingdom and China.

The results of this exploration are inconclusive: there is simply not enough evidence available at present either to confirm or to refute the existence of a functional North Korean SLBM and SSB. North Korea's claims about its SLBMs are undermined by news of several apparently unsuccessful earlier test firings. Even accepting North Korea's claims about its SLBMs at face value, there is little proof that North Korea has succeeded in miniaturizing its nuclear warheads, so the most extravagant fears are not justified. Nevertheless, the North Korean determination to possess such assets should not be taken lightly, as evidenced by the building of a new and larger SSB and the successful flight test of a solid-propellant SLBM.<sup>104</sup>

Taken together with North Korea's announcement of a supposed test of a hydrogen bomb on January 6 and of an ICBM on February 7, 2016, the KN-11 SLBM claims probably should be seen primarily as part of an effort to establish North Korea as a nuclear power, both to exert external political pressure and to bolster internal political support for Kim Jong Un's rule.

In recent years, South Korea has played a subtle and skillful diplomatic game, balancing the ROK-U.S. military alliance with the ROK-China strategic cooperative partnership. The received wisdom is that continuing this strategy offers the

most plausible chance of ultimately resolving the tensions and threats arising from North Korea. But for the diplomatic track to succeed, it is essential to prepare appropriate military options as well, both as a backup strategy and to focus minds and bring urgency to the diplomacy.

The ROKN should formulate a preemptive anti-exit strategy, acquire P-8s, build an ASW CV and SSNs to implement submarine strategic deterrent patrols, and extend the existing limited AORs to facilitate the preemptive anti-exit strategy. Other deterrence options could be considered, but surely it is significant that the ROKN for the first time recently referred publicly to the idea of deploying an ASW CV and SSNs.

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#### NOTES

The author would like to thank Rear Adm. Mike McDevitt, USN (Ret.), for his insightful comments on this article. He made some very valuable and thought-provoking points that tightened and strengthened the arguments herein. Following his suggestion, the policy of preemptive response recommended for the ROKN has been termed an “anti-exit” strategy.

1. This article mainly relies on analytic articles and reports published in South Korea, North Korea, and the United States, but generally refrains from referring to some institutions and individuals concerned with monitoring North Korea (e.g., 38 North) that take an avowedly proactive stance. Although some of these may be credible sources, at least with regard to the substance of North Korean weapons of mass destruction threats, the intent of this article is to focus on South Korean and U.S. reactions to submarine-launched ballistic-missile developments and their implications for policy on coping with North Korea’s defiance of international opinion.
2. Several different English, Korean, and Chinese names have been applied to the prototype North Korean SLBM, including Red Star-1, Polaris-1, Bukkeuksong-1, Musudan, 北極星-1號, and 無水端. ROK Ministry of National Defense (MND) has officially code-named it KN-11.
3. The official (North) Korea Central News Agency published a quite extraordinary report that compared the SLBM test to North Korea’s three nuclear bomb tests and to its indigenous, satellite-launching, three-stage rocket. In South Korea, the event was depicted in epochal terms: “Editorial: A Sputnik Moment?,” *Korea Joongang Daily*, May 11, 2015, p. 8.
4. Since North Korea’s fourth nuclear test and the UN Security Council’s response imposing stricter sanctions, there has been considerable speculation about North Korea’s surprising attitude in rebuking China. See Charlie Campbell, “A North Korean Satellite Launch Angers China,” *Time*, February 15, 2016, p. 13, and Shin Hyon Hee, “North Korea Fires Two Ballistic Missiles, One Explodes Midair,” *Korea Herald*, March 19–20, 2016, p. 4.
5. Christopher P. Cavas, “Seeking Game Changers in the Underwater World,” *Defense News*, November 27, 2015, [www.defensenews.com/](http://www.defensenews.com/).
6. Andrew Forbes and Sukjoon Yoon, “Old and New Threats from North Korea against the Republic of Korea,” in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Sukjoon Yoon (Seoul, ROK: Korea Institute for Maritime Strategy [hereafter KIMS], 2011), pp. 17–56.
7. Jang Sae Jung and Hur Jin, “South Korean Military Monitors North Korean Test-Firing of First SLBM,” *Joongang Ilbo*, May 12, 2015, p. 1.
8. James Hardy, “North Korean SLBM Test Presents More Questions Than Answers,” *IHS Jane’s Defence Weekly*, May 20, 2015, p. 17.

9. Definite information is scarce, but several blogs and newspaper articles in South Korea and the United States have suggested that North Korean tests to evaluate the ejection of a submerged ballistic missile from a static launcher on land, rather than a full test of a new missile system at sea, took place near the coastal city of Sinp'o in January and November 2014 and in January and April 2015.
10. Hyen Il Hoon, "North Korea Will Operate 9-Meter SLBM within 2 Years Period," *Joongang Ilbo*, May 12, 2015, p. 5; papers presented at the Eighth Maritime Security Workshop held by KIMS and the U.S. Center for Naval Analyses, Seoul, ROK, November 4–5, 2015.
11. Lee Willett, "Strategic Power: SSBNs Maintain Course in Evolving Security Environment," *IHS Jane's Navy International*, December 2015, pp. 13–14; Peter Felstead, "Annual Defence Report 2015: Asia-Pacific," *IHS Jane's Defence Weekly*, December 9, 2015, pp. 26–31.
12. During the last couple of decades, North Korea has declared itself a nuclear-armed nation, but the United States has not acknowledged this status. The United States describes North Korean policies as nuclear blackmail and as brinkmanship designed to intimidate the United States and South Korea.
13. Song Sang Ho, "N. Korea to Face Greater Dilemma over Nuke Policy," *Korea Herald*, December 23, 2015, p. 4.
14. Jeong Yong Soo and Sarah Kim, "North Test-Fires Its First Missile from a Submarine," *Korea Joongang Daily*, May 11, 2015, pp. 1–2.
15. Choe Sang Hun, "North Korea Says It Fired Missile from Submarine," *International New York Times*, May 11, 2015, p. 3.
16. Shin Hyon Hee, "N.K. Missile Test Escalates Tension," *Korea Herald*, May 11, 2015, p. 1.
17. "Editorials: N.K. News Briefings," *Korea Herald*, April 5, 2016, p. 14.
18. David E. Sanger and Choe Sang Hun, "North Korea Says It Detonated Hydrogen Bomb for First Time," *International New York Times*, January 7, 2016, pp. 1, 3.
19. Earlier claims were reported in the South Korean media. See Shin Hyon Hee, "North Korean Leader Kim Hints at Hydrogen Bomb Development," *Korea Herald*, December 11, 2015, p. 3, and Kang Jin Kyu, "We Have Hydrogen Bomb, Says Kim Jong-un," *Korea Joongang Daily*, December 11, 2015, pp. 1–2. For the upgrading of the North Korean launch facility, see "Upgrade of N. Korea's Launch Site Almost Complete: 38 North," *Korea Herald*, December 11, 2015, p. 3; Choe Sang Hun, "North Korea Warns U.S. of a Nuclear Strike," *International New York Times*, March 28, 2016, p. 4; and Choe Sang Hun, "North Korea Says It Tested ICBM Engine Successfully," *International New York Times*, April 11, 2016, p. 2.
20. Kang Jin Kyu, "North's Submarine Is Reported Marred in Test," *Korea Times*, December 10, 2015, p. 2; "Pyongyang Still Pursuing SLBM Capabilities," *Korea Joongang Daily*, January 7, 2016, p. 2; Song Sang Ho, "N.K. to Deploy SLBM in 3–4 Years," *Korea Herald*, January 11, 2016, p. 3.
21. There remain two major technical questions: Can North Korea miniaturize a nuclear warhead for long-range delivery, and can it build reliable delivery systems capable of land/air/sea launching? See Markus Schiller, Robert Schmucker, and James Kim, "Not Much below the Surface? North Korea's Nuclear Program and the New SLBM," *FAS Bulletin* (Summer/Fall 2015), available at [fas.org/](http://fas.org/); Hardy, "North Korean SLBM Test Presents More Questions Than Answers," p. 17; Kim Chul Hwan, "If North Korea Creates Military Provocations, It Will Be the Loser," *Kookbang Ilbo*, May 11, 2015, p. 1.
22. Both Korean-language and English-language newspapers have focused on the changing balance of power between the navies of the two Koreas, including *Kookbang Ilbo*, *Chosun Ilbo*, and *Joongang Ilbo*, and the *Korea Herald*, *Korea Times*, and *Korea Joongang Daily*.
23. Resolutions available at [www.un.org/](http://www.un.org/).
24. The two most important indications of her unification policy are the Dresden Declaration in 2014 and the establishment of the National Preparatory Committee for Unification in 2015. "Full Text of Park's Speech on N. Korea," *Korea Herald*, March 28, 2014, [www.koreaherald.com/](http://www.koreaherald.com/).
25. Choe Sang Hun, "North and South Korea Agree to Working-Level Border Talks," *International New York Times*, November 21–22,

- 2015, p. 5; *Trustpolitik 2015* (Seoul, ROK: December 2015), pp. 12–13.
26. Sukjoon Yoon, “China’s WW2 Victory Parade: Why Park Is Attending,” *RSIS Commentary*, no. 185 (August 28, 2015); Ministry of Foreign Affairs, *Trustpolitik 2015*, p. 301.
27. Yoon Min Sik, “Korea-U.S. Drills Focus on Striking N.K. Leadership,” *Korea Herald*, March 3, 2016, p. 1.
28. Kim Jong Un ordered a nationwide alert against South Korea and the United States, making various types of WMD threats. See Kim So Hee, “North Threatens Nuclear Strikes,” *Korea Joongang Daily*, March 8, 2016, pp. 1–2; Choe Sang Hun, “North Korea Test-Fires Missiles, Defying Ban by United Nations,” *International New York Times*, March 11, 2016, p. 3; Kim So Hee and Jeong Yong Soo, “Missiles Fired by North Korea, but One Doesn’t Work,” *Korea Joongang Daily*, March 19–20, 2016, p. 1; Yoon Min Sik, “N. Korea Leader Inspects Landing Drill Targeting South,” *Korea Herald*, March 21, 2016, pp. 1, 3; Kim So Hee and Jeong Yong Soo, “Pyongyang Launches Five Missiles into the East Sea,” *Korea Joongang Daily*, March 22, 2016, p. 1; Yoon Min Sik, “N.K.’s Saber-Rattling Is No Bluff: Ministry,” *Korea Herald*, March 23, 2016, p. 3; Kim So Hee, “Attack Drill Sparks Retaliation Vow from North,” *Korea Joongang Daily*, March 24, 2016, p. 1; and Choe, “North Korea Warns U.S. of a Nuclear Strike,” p. 4.
29. Campbell, “A North Korean Satellite Launch Angers China,” p. 13.
30. Schiller, Schmucker, and Kim, “Not Much below the Surface?”; Hardy, “North Korean SLBM Test Presents More Questions Than Answers,” p. 17; Kim Sung Gael, “North Korean SLBM Seems to Be Far-Fetched Political Propaganda,” *Kookbang Ilbo*, December 17, 2015, p. 12.
31. Hardy, “North Korean SLBM Test Presents More Questions Than Answers,” p. 17; Willett, “Strategic Power,” p. 13.
32. Kang, “North’s Submarine Is Reported Marred in Test,” p. 2; Kim, “North Korean SLBM Seems to Be Far-Fetched Political Propaganda,” p. 12.
33. Baek Il Hyun and Ser Myo Ja, “North Has Continuously Chased Its Nuclear Goals,” *Korea Joongang Daily*, January 7, 2016, p. 2.
34. Jung Yong Soo, “ROK MND Is Concerned about Its Effect of Neutralizing KAMD and THAAD,” *Joongang Ilbo*, May 11, 2015, p. 5.
35. The bastion concept of SSB or SSBN operations is the basic naval strategy that was employed by the ballistic-missile submarine fleets of the Soviet Union during the Cold War. Submarines remain within the heavily defended waters that constitute the “bastion” so they can launch a full-scale second strike without fear of counterattack, or can launch a limited nuclear attack while retaining the option to fire the rest of their missiles later. The Chinese People’s Liberation Army Navy may be using the same defensive strategy with its Xia- and Jin-class SSBNs, since it is much influenced by the Soviet concept of submarine operations. See Tom Stefanick, *Strategic Antisubmarine Warfare and Naval Strategy* (Lexington, KY: Lexington Books, 1987), p. 7.
36. Kang, “North’s Submarine Is Reported Marred in Test,” p. 2.
37. It was earlier reported in the media that commercial satellites had captured images of debris—namely, the capsule covering the SLBM—from an unsuccessful SLBM launch.
38. Kim, “North Korean SLBM Seems to Be Far-Fetched Political Propaganda,” p. 12.
39. This argument has been reported by various sources in Seoul and Washington, as well as in Tokyo. For instance, Kim Sung Geul, “Special Report: North Korean SLBM-KN-11; 4 Experimental Test-Firings,” *Kookbang Ilbo*, May 18, 2016, p. 14.
40. Sarah Kim and Jeong Yong Soo, “Navy Finds Missile Launch Debris,” *Korea Joongang Daily*, February 12, 2016, p. 2.
41. Kim, “Special Report,” p. 14.
42. *IHS Jane’s Defence Weekly* and a Chinese magazine have reported that DigitalGlobe satellite images of Sinp’o dockyard from March 2, 2015, apparently show North Korea’s new Sinp’o-class SSB next to a submersible missile-testing barge. It seems that historical images of a Soviet PSD-4 missile barge and its schematics may have influenced the North Korean design. See Hardy, “North Korean SLBM Test Presents More Questions Than Answers,” p. 17; 王丹 [Wang Dan], 朝鮮新浦級常規彈道導彈潛艇 [“North Korean Sinp’o-Class SSB”], 現代艦船 [Modern Ships]

- 13, no. 7A (2015), pp. 54–56; 崔轍亮 [Choi Tie Lang], 朝鮮水下戰略 [“North Korean Underwater Strategy”], 現代艦船 [Modern Ships] 13, no. 7A (2015), pp. 57–59.
43. Choi Byung Gun and Jeong Yong Soo, “North Korean ICBM Is a Wild Card for Talks with the U.S., but SLBMs Are the Crucial Issue for the U.S. and Its Allies,” *Korea Joongang Daily*, April 26, 2016, p. 6; Richard D. Fisher Jr., “North Korea Releases Images of Third SLBM Test,” *IHS Jane’s Defence Weekly*, May 4, 2016, p. 5; Nick Hansen, “North Korea Building New, Larger Submarine Pens,” *IHS Jane’s Defence Weekly*, July 27, 2016, p. 6; Gabriel Dominguez, “North Korea Conducts Successful SLBM Test-Firing,” *IHS Jane’s Defence Weekly*, August 31, 2016, p. 6.
  44. Neil Gibson, “Analysis,” *IHS Jane’s Defence Weekly*, August 31, 2016, p. 6.
  45. Fisher, “North Korea Releases Images of Third SLBM Test,” p. 5; Dominguez, “North Korea Conducts Successful SLBM Test-Firing,” p. 6; Lee Joo Hyung, “North Korean SLBM Will Be Completed in 3–4 Years,” *Kookbang Ilbo*, April 25, 2016, p. 2; Agence France-Presse, “Report: N. Korea Renovated Shipyard for New Class of Submarines,” *Defense News*, May 9, 2016, p. 19; Hansen, “North Korea Building New, Larger Submarine Pens,” p. 6.
  46. Hansen, “North Korea Building New, Larger Submarine Pens,” p. 6; Lee Yong Jong, “New Facility in Sinpo Port and Speculation about Nuclear-Powered Submarine,” *Korea Joongang Daily*, July 26, 2016, p. 18.
  47. Reuben F. Johnson, “Analysts Remain Skeptical of North Korea’s Nuclear Strike Claims,” *IHS Jane’s Defence Weekly*, March 16, 2016, pp. 4–5.
  48. Schiller, Schmucker, and Kim, “Not Much below the Surface?”; Wang, “North Korean Sinp’o-Class SSB,” pp. 54–56; Choi, “North Korean Underwater Strategy,” pp. 57–59; Kim, “Special Report,” p. 14.
  49. Victor Cha, “North Korean SLBM Launch,” *Critical Questions* (blog), May 11, 2015, www.csis.org/; Kim, “Special Report,” p. 14.
  50. See the published papers of the Eighth Maritime Security Workshop held by KIMS and the U.S. Center for Naval Analyses in Seoul on November 4–5, 2015, at which North Korean SLBMs and Sinp’o-class SSBs were discussed extensively. Contributors included retired naval officers and experts from private and quasi-governmental institutions concerned with maritime security. KIMS will publish the proceedings as a book entitled *Evolution of the Maritime Security Environment in Northeast Asia and ROKN-USN Cooperation*.
  51. Felstead, “Annual Defence Report 2015,” pp. 30–31.
  52. Nicholas de Larrinaga, “Russian Submarine Fires Cruise Missiles into Syria,” *IHS Jane’s Defence Weekly*, December 16, 2015, p. 9; Kim Jong Min, “North Korean SLBM Launch and ROKN’s Response,” *KIMS Admiral Sohn Won Il Forum 2*, no. 10 (May 26, 2015).
  53. Tim Ripley, “Russian Black Sea Fleet Fires More Cruise Missiles at Syrian Targets,” *IHS Jane’s Defence Weekly*, August 31, 2016, p. 5.
  54. Choi Hyeon Soo, “Peter Brennan Says North Korea May Operate a Functional Sinp’o-Class SSB,” *Kukmin Ilbo*, November 5, 2015, available at news.kmib.co.kr/.
  55. See Kim, “North Korean SLBM Seems to Be Far-Fetched Political Propaganda,” p. 12, and Kim, “Special Report,” p. 14.
  56. Choe, “North Korea Says It Fired Missile from Submarine,” p. 3.
  57. Song Sang Ho, “Peninsula Conflict Would Have Greater Regional Impacts: U.S. JCS Chief,” *Korea Herald*, December 16, 2015, p. 4.
  58. Shin, “N.K. Missile Test Escalates Tension,” pp. 1, 6.
  59. ROK MND, *Defense White Paper 2014* (Seoul, ROK: 2014), pp. 58–59. KAMD has been allocated 1.72 trillion Korean won between 2016 and 2020, receiving more than 50 percent of the ROK’s force-improvement program budget. See Paik Jae Ok, “Special Issue: Analysis and Perspective of ROK Defense Budget,” *Kookbang Ilbo*, May 18, 2015, p. 15, and Shin Hyon Ho and Hur Jin, “South Korea Is Concerned about North Korean Test-Fire of SLBM,” *Joongang Ilbo*, May 11, 2015, p. 4.
  60. Jung, “ROK MND Is Concerned,” p. 5; Peter Felstead, “North Korea’s Rocket Launch Reveals Use of ‘Cloaking’ Measures,” *IHS Jane’s Defence Weekly*, February 17, 2016, p.



- 6; Jun Ji Hye, "THAAD Talks Likely to Lose Momentum: Saenuri Party's Defeat Expected to Derail Talks," *Korea Times*, April 15, 2016, available at [www.koreatimes.co.kr/](http://www.koreatimes.co.kr/).
61. Lee Dong Hyen, "Japanese Defense Minister Refers to the Need for THAAD for the First Time," *JoongAng Ilbo*, November 25, 2015, p. 16.
62. Gabriel Dominguez, "Japan, US, South Korea Conduct Joint Missile-Tracking Exercise," *IHS Jane's Defence Weekly*, July 6, 2016, p. 5.
63. Bae Hyun Jung, "NK Succeeds in Sub Missile Test," *Korea Herald*, August 25, 2016, p. 1; Choe Sang Hun and Jane Perlez, "North Korea Test Lifts Nuclear Stakes," *International New York Times*, September 10–11, 2016, pp. 1, 6; Shin Hyun Hee, "China Blocks U.N. Response to N.K. Test," *Korea Herald*, August 5, 2016, p. 3; Kang Jin Kyu, "China Pulls Rug from UN Condemnation of North's Launch," *Korea JoongAng Daily*, August 11, 2016, p. 2; William J. Broad, "North Korea Seems Nearer to Hitting U.S.," *International New York Times*, September 12, 2016, pp. 1, 4.
64. Sukjoon Yoon, "Implications of Xi Jinping's 'True Maritime Power': Its Context, Significance, and Impact on the Region," *Naval War College Review* 68, no. 3 (Summer 2015), pp. 40–63; Kim So Hee and Yeh Young June, "Pyongyang Lauds Achievements as All Seems Calm," *Korea JoongAng Daily*, January 8, 2016, p. 2; Choe Sang Hun, "Nuclear Test Lets Kim Pit U.S. against the Chinese," *International New York Times*, January 11, 2016, pp. 1, 3.
65. Choe Sang Hun, "U.S. to Press North Korea If China Doesn't," *International New York Times*, January 21, 2016, p. 5.
66. Kang Jin Kyu, "North's Sixth Nuke Test Could Come at Any Time," *Korea JoongAng Daily*, September 13, 2016, pp. 1–2.
67. Song Sang Ho, "N.K. Female Band Draws Spotlight after Canceled Beijing Show," *Korea Herald*, December 14, 2015, p. 2; Shin, "North Korean Leader Kim Hints," p. 3.
68. Victor Cha and Robert L. Gallucci, "North Korean Delusions," *International New York Times*, January 9–10, 2016, p. 9.
69. Wang, "North Korean Sinpò-Class SSB," pp. 54–56.
70. Kim Sung Gael, "3 Issues for the Japanese Defense Armament Agency," *Kookbang Ilbo*, November 19, 2015, p. 12; Kim Du Sung, "Japan Wanted to Exercise Its Collective-Defense Authority," *Kookbang Ilbo*, November 26, 2015, p. 12.
71. Choi, "North Korean Underwater Strategy," pp. 57–59.
72. Sukjoon Yoon, "Expanding the ROKN's ASW Capabilities to Deal with North Korean SLBMs," *PacNet*, no. 31 (May 28, 2015).
73. Choe, "North Korea Says It Tested ICBM Engine Successfully," p. 3.
74. Song, "Peninsula Conflict Would Have Greater Regional Impacts," p. 4.
75. The author thanks one of the *Naval War College Review* referees for drawing his attention to some expert assessments of North Korea's nuclear capabilities. The number of deployed nuclear warheads is difficult to gauge, but a better guess can be made of the number placed on missiles or located at bases with missile operational forces. Estimates vary widely, from between four and six to between twenty and fifty, with some even suggesting a doubling of the higher value by 2020. The numbers used in this article come from two recent assessments of North Korea's stockpile of nuclear warheads: Robert Kelley and Alison Evans, "North Korea Carries Out Fourth Nuclear Test," *IHS Jane's Defence Weekly*, January 13, 2016, p. 6, and Geoff Dyer, "Nuclear Upgrade Raises Arms Race Fears," *Financial Times*, March 31, 2016, p. 6.
76. Ser Myo Ja, "Park Views Test-Firing of New Missile," *Korea JoongAng Daily*, June 4, 2015, p. 6.
77. Lee Jung Hyung and Kim Chul Hwan, "If North Korea Threatens, Retaliate Firmly," *Kookbang Ilbo*, May 13, 2015, p. 1.
78. Shin Yong Ho and Jeong Yong Soo, "ROK Establishes Underwater KAMD to Defend, Detect, Disrupt and Destroy North Korean SLBMs," *JoongAng Ilbo*, May 13, 2015, p. 3.
79. ROK MND, *ROK Military Reform 2014–2030: Basic Plan* (Seoul, ROK: 2014).
80. Ridzwan Rahmat, "South Korea and Japan to Receive Aegis Baseline 9 for New Destroyers," *IHS Jane's Defence Weekly*, August 24, 2016, p. 19; Jeong Yong Soo and Kang Jin Kyu, "South

- Will Purchase Baseline 9 System, THAAD of the Sea," *Korea Joongang Daily*, August 18, 2016, p. 2.
81. Daniel Wasserbly and James Hardy, "US Eyes Close BMD Collaboration with Japan and South Korea," *IHS Jane's Defence Weekly*, June 4, 2014, p. 11; Daniel Wasserbly, "USN's SM-6 and Over-the-Horizon Fire Control Score Intercepts at Sea," *IHS Jane's Defence Weekly*, July 16, 2014, p. 13; Richard Scott, "SM-3 Block IIA Program Set for CTV Test," *IHS Jane's Defence Weekly*, January 21, 2015, p. 11; Daniel Wasserbly, "Next-Generation SM-3 Takes Its First Flight," *IHS Jane's Defence Weekly*, June 17, 2015, p. 7; Doug Richardson, "SM-6 Enters Full-Rate Production," *IHS Jane's International Defence Review*, June 2015, p. 14.
  82. Richard Scott, "Standard Missile-3 Block Intercept Completes Second Flight Test," *IHS Jane's Defence Weekly*, December 16, 2016, p. 5.
  83. Kim, "North Korean SLBM Launch and ROKN's Response," pp. 2-3.
  84. Kelvin Wong, "USN P-8s Begin Maritime Surveillance Operations out of Singapore," *IHS Jane's Defence Weekly*, December 16, 2015, p. 16.
  85. ROKN, *Past Navy and Future Navy* (Kyeoyongdae, ROK: 2014), pp. 111-12; ROK MND, *Defense White Paper 2014*, pp. 12-13.
  86. This was demonstrated starkly by the February 2009 collision in the Atlantic Ocean between the U.K. Royal Navy's HMS *Vanguard* and the French navy's *Le Triomphant*. Both SSBNs were traveling at what were reported to be very low speeds, and they simply could not hear each other. See Willett, "Strategic Power," p. 13.
  87. The strict ROEs imposed on the ROKN have been a major issue in developing concepts for preemptive strike capability since the sinking of ROKS *Cheonan* (PCC 722) in March 2010. See Sukjoon Yoon, "Some Current Issues in Korean Maritime Security and Maritime Strategy," in *Korean Maritime Strategy*, ed. Till and Yoon.
  88. Ridzwan Rahmat, "Batten Down the Hatches: South Korean Yards Prepare for Challenges," *IHS Jane's Navy International*, October 2015, pp. 18-23.
  89. Lee and Kim, "If North Korea Threatens, Retaliate Firmly," p. 1; Shin and Jeong, "ROK Establishes Underwater KAMD," p. 3.
  90. Richard Scott, "Sound Effects: Low-Frequency Active Sonar Comes of Age," *IHS Jane's Navy International*, May 2015, pp. 26-31.
  91. There are two ways to classify ROKN KDX destroyers. First, the ROK MND Force Improvement Project classifies them as *Gwanggaeto*-class KDX-I/II/III, following a system similar to that used for naming ROK Army main battle tanks, such as K-1/2/9. These appear to be the official names, as used in ROKN publications. The second method is to use the name of the first ship in the KDX batch, such as *Gwanggaeto*, *Yi Sun Shin*, or *King Sejong the Great*. This system is often used in other publications, such as *IHS Jane's Fighting Ships*. Both methods have their uses, depending on whether the class or the batch of KDXs or of SSK submarines is considered more relevant in a given context.
  92. ROKN, *A Way of ROKN and Direction of Future* (Seoul, ROK: 2015); Jeong and Kim, "North Test-Fires Its First Missile from a Submarine," pp. 1-2.
  93. Park Jae Yoon, "President Park Ordered Firm Military Posture against North Korean Military Provocations," *Kookbang Ilbo*, May 13, 2015, p. 1.
  94. Yoon, "Expanding the ROKN's ASW Capabilities."
  95. Kyon Gae Choi, "Allies to Reinforce Info Sharing against NK Submarine Threats," *Korea Herald*, August 29, 2016, p. 4; Jeong Yong Soo and Kang Jin Kyu, "Seoul Shops for Anti-sub Aircraft," *Korea Joongang Daily*, September 1, 2016, p. 2; Lee Chung Hyung, "South Considers Nuclear Submarines to Defend against North," *Korea Joongang Daily*, September 9, 2016, p. 2.
  96. The source says that a secret task force was established to study the possibility of adopting an indigenous nuclear propulsion system for *Chang Bogo*-class KSS-III batch 3s, but owing to the political sensitivity of the decision the task force was disbanded. See Yoon Min Sik, "Can S. Korea 'Legally' Have a Nuclear-Powered Sub?," *Korea Herald*, August 30, 2016, p. 4.

97. Jeong and Kim, "North Test-Fires Its First Missile from a Submarine," pp. 1–2; ROK MND, *Defense White Paper 2014*, pp. 82, 87.
98. Kim, "North Korean SLBM Launch and ROKN's Response," p. 12.
99. *Ibid.*, pp. 2–3; Yoon, "Expanding the ROKN's ASW Capabilities."
100. Yoon, "Expanding the ROKN's ASW Capabilities."
101. Grace Jean, "US Navy's Lead *Zumwalt*-Class Destroyer Commences Sea Trials," *IHS Jane's Defence Weekly*, December 16, 2015, p. 4.
102. Bill Sweerman, "Naval UAV Concept in Flux," *IHS Jane's Navy International*, April 1, 2002, pp. 22–29.
103. J. F. Dunford, J. W. Greenert, and P. F. Zukunft, "A Cooperative Strategy for 21st Century Seapower: Forward, Engaged, Ready," March 2015, p. 23, available at [www.navy.mil/](http://www.navy.mil/).
104. Song, "N.K. to Deploy SLBM in 3–4 Years," p. 3.