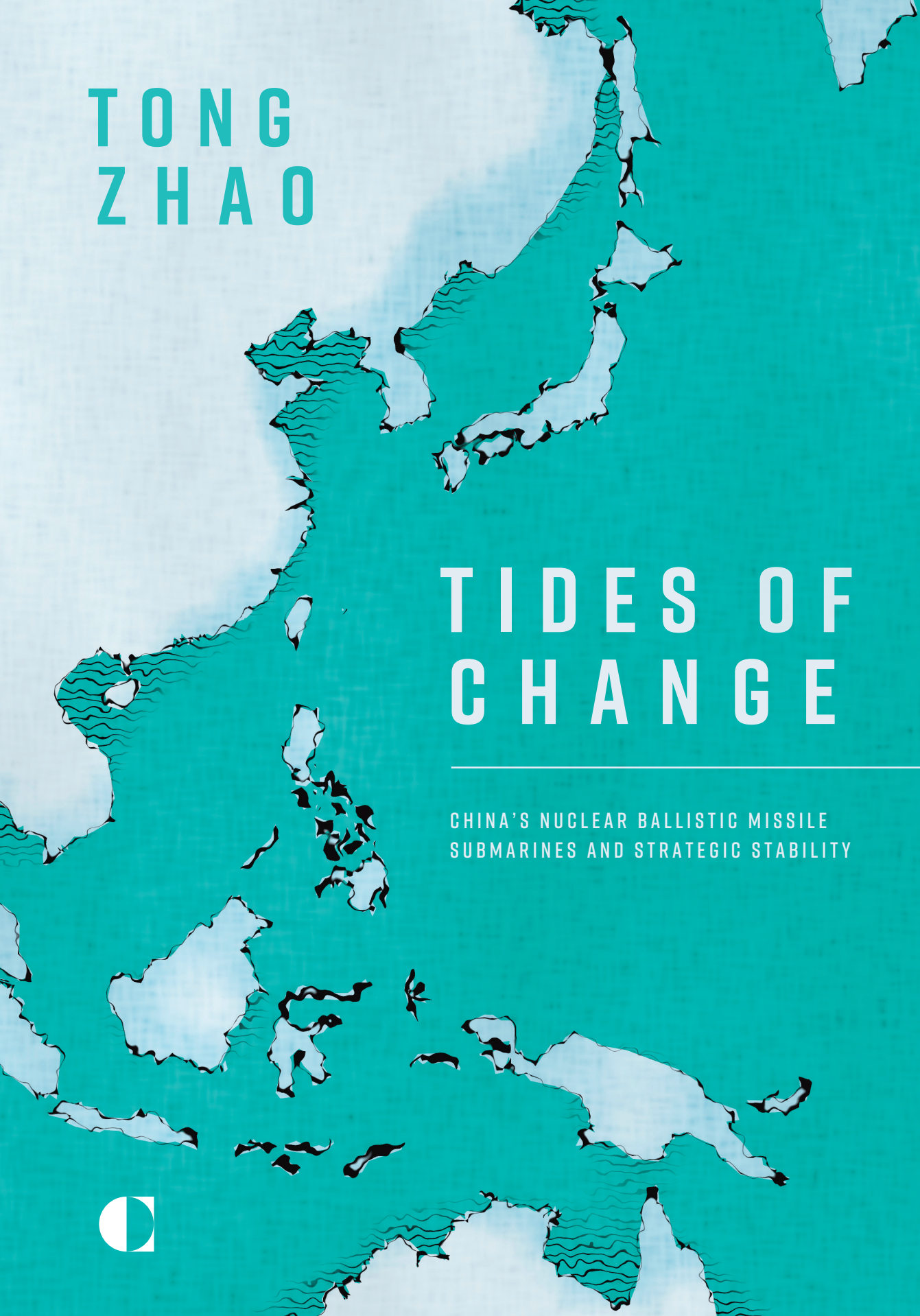
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CHANGE
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SUBMARINES AND STRATEGIC STABILITY

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LIST OF ACRONYMS

A2/AD	anti-access area denial
ACTUV	ASW Continuous Trail Unmanned Vessel
ASEAN	Association of Southeast Asian Nations
ASW	anti-submarine warfare
C3	command, control, and communication
CCTV	China Central Television
CUES	Code for Unplanned Encounters at Sea
DARPA	Defense Advanced Research Projects Agency
EEZ	exclusive economic zone
ELF	extremely low frequency
FONOP	freedom of navigation operation
ICBM	intercontinental ballistic missile
JAM-GC	Joint Concept for Access and Maneuver in the Global Commons
NEW START	New Strategic Arms Reduction Treaty

NFU	no-first-use (policy)
NPR	Nuclear Posture Review
NPT	Nuclear Non-Proliferation Treaty
PLA	People's Liberation Army
SSBN	ship submersible ballistic nuclear (nuclear ballistic missile submarine)
SSN	ship submersible nuclear (nuclear attack submarine)
SLBM	submarine-launched ballistic missile
SLF	super low frequency
SLOC	sea line of communication
TACAMO	take charge and move out
THAAD	Terminal High Altitude Area Defense
UNCLOS	United Nations Convention on the Law of the Sea
USV	unmanned surface vehicle
UUV	unmanned underwater vehicle

EXECUTIVE SUMMARY

IN RECENT YEARS, China has expended considerable efforts to build a sea-based nuclear force for the primary purpose of enhancing its overall nuclear deterrent. Although Beijing's goal is limited and defensive, the practical implications of its efforts for regional stability and security will be significant.

ARMS RACE STABILITY

A fleet of survivable nuclear ballistic missile submarines (SSBNs) would reduce China's concerns about the credibility of its nuclear deterrent and lessen the country's incentives to further expand its arsenal. Such benefits, however, will be tempered by vulnerabilities associated with Beijing's current generation of SSBNs. In the near to mid-term, developing an SSBN fleet will require China to substantially enlarge its previously small stockpile of strategic ballistic missiles, possibly exacerbating the threat perceptions of potential adversaries and causing them to take countermeasures that might eventually intensify an emerging arms competition.

China needs to use substantial general-purpose forces to protect its SSBNs in coastal waters. This requirement will become an important driver of a buildup of China's conventional military assets. Efforts to protect Chinese SSBNs, especially in the South China Sea, could be interpreted by neighboring countries as attempts to undermine others' freedom of navigation, to expand China's sphere of influence, and to seek regional dominance. Such concerns could intensify already fraught arms race dynamics in East and Southeast Asia.

CRISIS STABILITY

A sea-based nuclear capability will not make China more inclined to use nuclear weapons during a crisis. Nonetheless, the country's emerging SSBN force will still have important implications for crisis stability. Beijing may abandon its traditional practice of maintaining a low alert level for its nuclear weapons in peacetime and instead arm its sea-launched ballistic missiles with nuclear warheads during routine SSBN patrols. There is also uncertainty over how reliable China's SSBN command, control, and communication system is and how Beijing assesses the risk of foreign interference with this system. As a result, China may face a difficult choice between maintaining a highly centralized command and control system and giving SSBN crews some autonomy, including perhaps by pre-delegating launch authority for nuclear weapons under certain circumstances. If China concludes that it must take the latter route, the risk of an accidental and/or unauthorized launch of a sea-based nuclear ballistic missile will be higher.

Moreover, China's deployment of SSBNs will, for the first time, make its nuclear weapons vulnerable to foreign military attacks outside of the country's territory. Foreign countries could use non-nuclear military forces, including unmanned systems, to track, trail, and attack Chinese SSBNs, creating a dilemma over how Beijing should respond if one of its SSBNs faces a conventional military threat during a crisis. As the United States and its allies continue to enhance their anti-submarine warfare (ASW) capabilities in the region, China may feel increasing pressure to reconsider its unconditional no-first-use policy. If that were to happen, Beijing may inadvertently motivate potential adversaries to further intensify their strategic ASW operations against Chinese SSBNs. Moreover, due to the technical difficulty of assessing intentions, the risk of an overreaction would increase, as China may mistake ASW operations against its attack submarines for operations against its SSBNs.

China's likely reliance on general-purpose forces to protect its SSBNs, especially if Beijing finds it necessary to obtain sea-control capabilities and create SSBN bastions in the South China Sea, would probably heighten the risk of clashes between China's conventional forces defending its SSBNs and enemy ASW platforms. The likelihood of incidents and inadvertent escalation may be further exacerbated by the technical and logistical difficulties of maintaining effective command, control, and communication systems in a contested maritime environment. The introduction of unmanned systems—whether surface vessels or underwater vehicles—would present further challenges, including the need for effective communication between two camps of hostile forces to avoid incidents.

RISK REDUCTION

Formal and verifiable arms control agreements are unlikely to be a realistic response to these risks, given the mutual distrust between the two countries and the extreme secrecy over submarine operations. Instead, cooperative and/or unilateral confidence-building measures

should be pursued as the first step toward mitigating the negative potential consequences for arms race and crisis stability. At the senior political level, it is time for the United States to clarify its policy toward China's sea-based nuclear weapons. U.S. decisionmakers should recognize that pursuing ASW capabilities against China's SSBNs contradicts their commitment to maintaining strategic stability with Beijing. A U.S. declaratory policy that explicitly rejects the option of conducting strategic ASW against China would help mitigate Beijing's concerns and thus discourage it from adopting a more destabilizing military posture. For its part, China should reassure the international community about the strategic objectives behind its SSBN program by shedding more light on its views about the future development of and operational requirements for its SSBN force. Doing so could help other states better assess for themselves whether China's SSBN program is guided by the limited objective of ensuring a nuclear second-strike capability, or whether it is a more open-ended effort driven by resource availability and/or expansionist ambitions.

At the operational level, confrontations stemming from China's efforts to protect its SSBNs and foreign ASW forces are likely to continue for the foreseeable future. It is important to start exploring possible rules of the road to regulate interactions between such forces, including in scenarios in which unmanned vehicles are employed. This process should involve both U.S.-Chinese bilateral efforts and a broader regional overture. To build trust among all relevant parties, greater transparency and voluntary restrictions by China about its SSBN operational principles and deployment postures would be helpful, as would practical steps to reaffirm China's negative security assurances to regional countries and its early signing and ratification of the Protocol to the Southeast Asia Nuclear-Weapon-Free Zone Treaty.

Looking ahead, China should take a number of unilateral measures to further enhance strategic stability while securing its own interests. Beijing should choose to live with a relatively small SSBN force, which would be sufficient for maintaining the credibility of its sea-based nuclear deterrent. Keeping a moderate alert status for its SSBNs and not rushing to adopt continuous-at-sea SSBN patrols would also help to ensure effective deterrence without creating unnecessary risks.

Finally, there is a need for serious domestic discussions about what development and deployment strategy makes the most sense for China's sea-based nuclear weapons. Some Chinese analysts and commentators appear to hold major misunderstandings about trends in foreign countries' development of SSBNs and, as a result, have advocated for risky policy alternatives. More in-depth domestic debate would be useful for enhancing understanding about the costs and benefits of different SSBN development and deployment strategies. Well-informed and prudent policy choices will improve China's own security interests, contribute to regional stability, and enhance Beijing's international image as a responsible nuclear power.

INTRODUCTION

IN THE 2018 Nuclear Posture Review (NPR) report, the administration of U.S. President Donald Trump commits to "maintaining strategic stability in Europe and Asia."[1] However, as the strategic competition and rivalry between the United States and China continues to intensify, it is becoming significantly harder to maintain a stable nuclear relationship between the two major powers in the Asia Pacific region. This challenge was not made easier when the 2018 NPR report refrained from pledging explicitly to strengthen the U.S.-China bilateral strategic stability relationship that had been an important commitment in the 2010 NPR report under former president Barack Obama.

In addition to the uncertainties introduced by new geopolitical factors, the task of maintaining a stable U.S.-China nuclear relationship faces considerable challenges generated by new technology and new capabilities being developed in both countries. Compared with the beginning of the twenty-first century, the most significant change in China's nuclear capability today is the induction of a young but rapidly growing fleet of nuclear ballistic missile submarines (often known as SSBNs, shorthand for ship submersible ballistic nuclear). Between Chinese efforts to create a credible sea-based nuclear deterrent and U.S. endeavors to strengthen anti-submarine countermeasures, tensions are brewing under the surface of the South China Sea and the broader Pacific Ocean, where existing territorial disputes and rising maritime military confrontations add further to the complexity of maintaining peace and stability. This development will affect China's national security posture and how the United States and other countries respond in turn. Consequently, China's nuclear-armed submarines have the potential to substantially reshape the national security landscape and the strategic stability of the Asia Pacific region.

Although China is just in the early stages of deploying its SSBNs, the rapid pace of technological and operational advances and the lengthy nature of military procurement timelines are already exacerbating existing threat perceptions and generating important policy reactions in the United States and other regional countries. Such interactions are posing important challenges to U.S.-China strategic stability that are not yet well understood. U.S. and Chinese analysts, military brass, and policymakers alike should carefully reassess and (when necessary) recalibrate their strategic assumptions, national security policies, and operational practices. There are constructive steps that Beijing and Washington can take—both by themselves and in concert—to responsibly manage the challenges to strategic stability posed by China's evolving deployment of nuclear assets at sea and the subsequent policy responses of the United States and its allies in Asia.

GRAPPLING WITH NEW CAPABILITIES AND CONCEPTS

CHINA'S BURGEONING SSBN fleet and the ways other countries respond will have far-reaching consequences for strategic stability in the Asia Pacific. In some respects, perceptions matter nearly as much as material capabilities. After all, how China conceptualizes strategic stability and how all relevant actors formulate and articulate their threat perceptions will profoundly shape the security ramifications of these far-reaching changes.

CHINA'S FAST-GROWING SSBN CAPABILITIES

On September 29, 2015, according to a *PLA Daily* report, China's Central Military Commission awarded the Forty-First Crew based at the Yalong Bay naval base on Hainan Island the prestigious First-Class Merit Medal.[2] Many analysts believe that the team received this award for conducting the first successful patrol on China's second-generation SSBN, the 094 class.[3] Either way, two years before that, this same Forty-First Crew reportedly received another award for successfully test launching China's second-generation submarine-launched ballistic missile (SLBM), the JL-2.[4] These successes were the result of decades of persistent efforts.

China's burgeoning SSBN fleet and the ways other countries respond will have far-reaching consequences for strategic stability in the Asia Pacific.

China's SSBN program can be traced back to 1958, when the country's leaders decided to start developing nuclear submarines.[5] By the late 1980s, China had commissioned its

first-generation 092-class SSBN, but that ship did not conduct any patrols.[6] It was reportedly too noisy and might have had other safety and reliability issues. Moreover, the missiles it carried had very short ranges. The introduction of the JL-2 and the first patrol by the 094-class SSBN—mean that China has obtained, for the first time, a demonstrably operational underwater nuclear capability. This represents the start of a new era for China's sea-based nuclear forces.

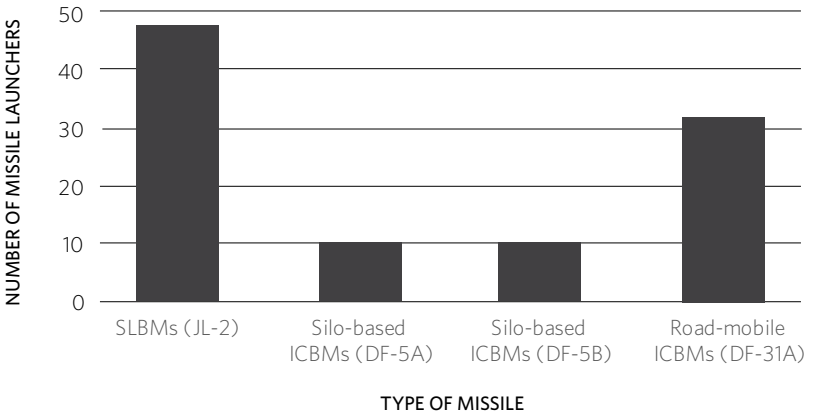
The rapid growth of China's SSBN fleet and other countries' responses to it will profoundly affect the strategic stability of the Asia Pacific.

The Pentagon has indicated that China has already deployed four 094-class SSBNs, according to a 2018 annual report to Congress on Chinese military activities.[7] The 2016 version of this report stated that China would build up to five 094-class SSBNs in total before moving on to build a third-generation SSBN, the 096 class, which might be armed with the new JL-3 SLBM.[8] A top senior U.S. military official and some civilian experts, however, have suggested that China's plans might be more expansive. For example, when he testified to Congress in 2015, then commander of U.S. Pacific Command Admiral Samuel Locklear implied that China might build up to eight 094-class SSBNs.[9]

Although the Chinese government itself has not revealed any details about the total planned size of its SSBN fleet, some retired senior Chinese military officers have argued that China should build up this force significantly. For example, retired Rear Admiral Yin Zhuo stated in 2014 that, within the next eight to twelve years, China will need at least eight SSBNs.[10] Retired Major General Zhu Chenghu went even further and argued that, to deter any country from launching a nuclear first strike against China, Beijing will need to maintain three to five SSBNs on patrol constantly.[11] If that is the case, China would need to possess about eight to fifteen SSBNs, given the constraints imposed by maintenance requirements. If China were to follow the advice of these experts, it would end up with a substantially larger SSBN fleet than the United Kingdom (UK) and France and might even surpass the size of the U.S. and Russian fleets.

Since China's first 094-class SSBN reportedly achieved initial operational capability in the late 2000s,[12] the relative significance of China's sea-based nuclear force has grown rapidly. Now Chinese SLBM launchers constitute a plurality (48 percent) of all Chinese ballistic missile launchers that could potentially launch strikes against the continental United States, as figure 1 illustrates.[13] Construction on China's 096-class SSBN may start by the early 2020s.[14] The size of China's SSBN force and the rapid pace of its development indicate that it is a top priority for China.

FIGURE 1. THE ESTIMATED NUMBER OF CHINESE BALLISTIC MISSILE LAUNCHERS THAT COULD STRIKE THE U.S. MAINLAND



Source: Hans M. Kristensen and Robert S. Norris, "Chinese Nuclear Forces, 2018," *Bulletin of the Atomic Scientists* 74, no. 4 (2018): 289–295.

CHINA'S UNDERSTANDING OF STRATEGIC STABILITY

The rapid growth of China's SSBN fleet and other countries' responses to it will profoundly affect the strategic stability of the Asia Pacific. Strategic stability is a term that originated in Western strategic thinking and whose definition varies from author to author. For the purposes of this report, strategic stability consists of two basic components: crisis stability and arms race stability.[15] Crisis stability can be assumed to exist when there is a low risk of an incident during peacetime inadvertently sparking a military crisis and when a country does not have incentives to use nuclear weapons first during a conventional military crisis. Meanwhile, arms race stability is when a country lacks incentives to build up nuclear and related supporting and enabling conventional capabilities. Theoretically, a highly survivable nuclear force would contribute to both crisis and arms race stability by reducing the incentives for countries to act preemptively in a crisis or to build a bigger arsenal in peacetime.

China's growing SSBN force may affect crisis stability in several ways. For instance, command-and-control challenges associated with the country's SSBN force might affect top policymakers' capability to maintain high situational awareness during a crisis. Bad situational awareness and concerns about losing control of these strategic capabilities could make policymakers more prone to thinking in terms of worst-case scenarios and lead them to use such weapons earlier than necessary. Depending on China's specific deployment strategies, the country's growing SSBN capability might reinforce (or undermine) the existing firewall between nuclear and conventional weapons, making a future conventional mili-

tary conflict less (or more) likely to escalate to the nuclear level. Existing Chinese SSBNs would depend heavily on conventional general-purpose forces for their survivability. This raises the question of what kind of signals the country's deployment and employment of such support forces during a crisis might send to an adversary and how those signals could affect escalation.

With regard to arms race stability, if China's SSBNs significantly contribute to the credibility of its overall nuclear deterrent, China would have less of an incentive to further enlarge its nuclear arsenal. That said, the survivability of its current generation of SSBNs is in question because of various technical and operational uncertainties. Moreover, foreign countries may view Chinese efforts to build up its SSBN fleet as part of a worrying trend of nuclear expansion that some observers worry could culminate in a Chinese sprint to parity with the United States and Russia (which, today, have much larger nuclear arsenals than China). Other countries may, therefore, react to China's SSBN development in ways that intensify the existing nuclear competition. To complicate matters further, there is uncertainty about whether China's SSBN development program has been guided by a clear strategic goal, or whether it is instead primarily driven by resource availability and/or parochial bureaucratic interests. If the program lacks a clearly defined strategic goal, then it may be more difficult for China to demonstrate that it will not keep expanding its SSBN force beyond what is needed for a minimum deterrent capability.

The implications of China's SSBN force for conventional arms races more generally also deserve serious attention. To protect its SSBNs, China needs to significantly increase its conventional general-purpose forces and may need to shift from a sea-denial to a sea-control deployment strategy in some parts of its coastal waters. Such an expansion of conventional forces and military goals would almost inevitably raise concerns in the region, especially among the states involved in serious maritime territorial disputes around the South China Sea.

For various reasons, China has not paid much attention to how its military developments—including its sea-based nuclear weapons—may affect strategic stability. The most important reason is that this Western term was only introduced to the Chinese strategic community in recent decades. In traditional Chinese parlance, strategic stability is a much broader concept that refers to a general state of balance between countries along various dimensions, including security, military power, alliance relations, and economic strength.[16] This general, abstract approach to strategic stability has long prevented Chinese analysts from thoroughly examining the potential impact of their military developments on crisis and arms race stability.

That said, as they interact with Western counterparts more, Chinese nuclear and strategic experts are becoming increasingly familiar with the Western concept of strategic stability, and they have started to use it as an analytical framework in their own research.[17] At the

same time, as China's relative global power grows and as the country becomes a key stakeholder on regional and international security issues, it is increasingly in Beijing's interest to prevent unnecessary crisis escalation and contain potential arms races.

Up until now, China's traditional emphasis on its own political intentions may have been preventing the country from fully appreciating the significance and impact of its own actions on strategic stability. Chinese experts view the country's development of SSBNs as driven exclusively by the defensive goal of reinforcing its second-strike nuclear capabilities, so they view this endeavor as fully justified, totally normal, and entirely legitimate. Confident that Beijing has no offensive or aggressive intentions, these experts rarely realize that other countries might interpret China's SSBN program differently.

To the extent that Chinese experts have examined China's development of SSBNs through the framework of strategic stability (in the Western sense), they have generally concluded that Chinese SSBNs have a positive impact. They reason that, by allowing China to keep a credible nuclear deterrent, the country's SSBN fleet helps maintain a relationship of mutually assured destruction between China and the United States and reduces the likelihood of a nuclear conflict.[18] This view is certainly true under certain conditions, but this simplified perspective does not consider the risk of unintended negative consequences.

Against this backdrop, the major implications—positive and negative—of China's growing SSBN force for strategic stability deserve careful attention. China's own conception of the impact its SSBNs will have on strategic stability can inform a systematic analysis of the much broader and more complex impact of such capabilities on both crisis stability and arms race stability. A key variable for assessing strategic stability in this respect is Chinese SSBNs' survivability, both in terms of the inherent survivability of China's SSBN fleet and how different operational strategies may affect it.

Other important variables complicate this picture. For instance, there are competitive interactive dynamics between the United States' strategic anti-submarine-warfare (ASW) capabilities and possible Chinese countermeasures to protect its SSBNs: certain anti-submarine and pro-SSBN capabilities and tactics may impact strategic stability. Moreover, new technologies—particularly unmanned systems—might change the strategic stability equation in the future. Finally, to help reduce the risk of China's SSBN forces and U.S. ASW assets sparking instability in the region, there are a number of cooperative and reciprocal confidence-building measures that Beijing and Washington should pursue. Apart from that, China has a few unilateral steps that it should take to ensure that the growth of its SSBN fleet is as undisruptive as possible to regional security dynamics and to its own security interests.

THE IMPACT ON STRATEGIC STABILITY: A GAP BETWEEN SELF-PERCEPTIONS AND REALITY

ALTHOUGH CHINESE EXPERTS and analysts have long viewed their SSBNs as motivated by defensive considerations and, therefore, beneficial for strategic stability, there are operational and developmental aspects to Beijing's SSBN program that reveal a more complex reality.

CHINA'S SELF-PERCEIVED CONTRIBUTION TO STRATEGIC STABILITY

For several decades, China possessed only a rudimentary nuclear weapons capability with limited survivability. Even today, the guaranteed viability of Beijing's arsenal is still a point of debate. Some Western scholars have recently argued that the United States may be able to preemptively destroy all of China's nuclear forces in a disarming first strike.[19] Some Chinese strategists share this opinion and fear that China's small arsenal of intercontinental ballistic missiles (ICBMs) does not provide a guaranteed second-strike capability.[20]

In response to this concern about its nuclear arsenal's perceived vulnerability, some senior Chinese military officials have traditionally argued that a sea-based nuclear capability would prove more survivable than land-based systems. Admiral Liu Huaqing once estimated that "fewer than 10 percent of China's land-based missiles would survive a large-scale nuclear first strike; the less vulnerable [submarine-launched ballistic missiles] SLBMs would preserve our nuclear counterattack capabilities."[21] Hailed as the father of the modern Chinese navy, Liu served from 1989 to 1998 as vice chairman of the Central Military Commission, China's top national security decisionmaking body. This assessment has not changed. As recently as

2011, other Chinese naval experts similarly concluded that only 5–10 percent of the country's land-based and airborne nuclear weapons would survive a nuclear first strike, whereas the projected survival rate of sea-based nuclear weapons could be as high as 90 percent.[22]

With that in mind, the goal of China's SSBN fleet—sometimes called the Second Nuclear Force—is to dispel any doubts potential adversaries may have about Beijing's retaliatory capability and to force Washington to recognize unequivocally that China and the United States have a nuclear relationship based on mutual vulnerability.[23] In assuming that the two countries are mutually vulnerable, Chinese experts expect that their SSBNs will greatly enhance strategic stability by deterring potential rivals from attempting a nuclear first strike or nuclear coercion in a crisis, and by dissuading any rivals from even attempting to obtain first-strike capabilities against China.

Although there are some reasons to wonder if Chinese concerns about the survivability of land-based nuclear weapons (versus sea-based ones) may be overstated, the fact remains that these concerns are widely shared among Chinese policymakers and inform policy accordingly. Admittedly, China has made impressive progress, in recent decades, on modernizing its land-based road-mobile nuclear missiles by improving their accuracy, mobility, and responsiveness. Moreover, Chinese naval experts have a parochial interest in promoting naval weapon systems. That being said, general concerns persist across the board among Chinese experts about the survivability of land-based systems, in some cases more acutely than before. In particular, experts worry that growing U.S. missile defense, conventional precision strike, and space-based surveillance capabilities could collectively facilitate sophisticated preemptive attacks that could pose a significant threat to China's land-based nuclear forces.[24]

Chinese strategists' perception that SLBMs are less vulnerable than other nuclear delivery systems proceeds from several understandings about SSBNs. First, SSBNs are highly mobile and can considerably "expand the combat area" by patrolling in open oceans and thus "increase the [geographical element of] surprise" of an attack.[25] Second, SSBNs can be extremely stealthy. Detecting and tracking enemy SSBNs requires a tremendous amount of military resources. Consequently, preemptively destroying SSBNs is "more difficult than destroying land-mobile launch system[s]."[26]

Sea-based nuclear weapons offer other advantages as well. Because SSBNs can launch missiles from close to an enemy's territory and thus reduce the time for the enemy to employ defensive measures, SLBMs have a better chance than ICBMs do of thwarting enemy missile defense capabilities.[27] Moreover, if located in the South Pacific, Chinese SSBNs would be able to launch missiles along trajectories not currently covered by U.S. missile defense radars.[28] In fact, the 2013 edition of the *Science of Military Strategy*—an important military textbook written by prominent Chinese military scholars and published by the People's Liberation Army's (PLA) Academy of Military Sciences—makes an explicit connection between U.S. missile defenses and China's SSBN program:

> Faced with the objective situation of the United States and countries on China's periphery actively developing missile defenses, developing China's sea-based deterrent force is significant for the reliability, credibility, and effectiveness of protecting China's nuclear deterrent and counterstrike capabilities.[29]

Foreign experts also have hypothesized that China could have other potential tactical motivations for acquiring SSBNs. Some U.S. experts, for example, have speculated that China could use its SSBN fleet to force the United States to divert ASW resources away from other important tasks. These experts suggest that, during a military crisis between the two countries, China could visibly mobilize its SSBNs to explicitly threaten the U.S. mainland and other core U.S. interests. According to this thinking, the goal would be to force the United States to devote more of its ASW resources—especially its nuclear-powered attack submarines (SSNs)—to finding and tracking Chinese SSBNs. This would leave U.S. aircraft carriers and other important surface ships without adequate protection from Chinese attack submarines.[30] While this strategy sounds possible in theory, it has not been seriously discussed in Chinese policy discourse; there is no evidence that China has embraced the idea of risking its SSBNs—a core strategic asset—for tactical military gains.

China views its SSBN capability not as a tactical military asset but as a strategic capability that is increasingly important for maintaining a credible second-strike capability.

Another argument in relevant foreign literature is that Chinese SSBNs are intended to hold Indian targets at risk as part of Beijing's efforts to exercise deterrence vis-à-vis New Delhi.[31] Scholars who advance this theory point out that, if deployed in the South China Sea, Chinese SSBNs could easily launch strikes against India without sailing into the Indian Ocean.[32] Relevant Chinese literature, however, only rarely expresses an interest in using SSBNs for deterrence against India.

Admittedly, if China were intent on threatening Indian targets using its SSBNs, it would not need to declare this goal openly. Yet there have been no indications, even in Chinese publications not intended for foreign consumption, that the possible deployment of SSBNs in the South China Sea is, even in part, driven by enhancing deterrence against India. That said, over the long term, Chinese strategists are watching Indian efforts to continue closing the gap between the two countries' nuclear capabilities by extending the range and number of Indian strategic missiles and building its own SSBNs.[33] If this trend continues, it is not entirely impossible that China may want its SSBNs to play a role in deterring India.

Despite these foreign theories, China views its SSBN capability not as a tactical military asset but as a strategic capability that is increasingly important for maintaining a credible second-strike capability against potential nuclear rival(s) and that, therefore, contributes to strategic stability. In reality, however, a systematic analysis of key operational and develop-

mental aspects of China's SSBN program shows that the overall impact on strategic stability of this program and of the likely countermeasures other countries might take in response is much broader and more complex.

CHINESE SSBN OPERATIONS AND CRISIS STABILITY

There are at least three key operational issues pertaining to China's SSBNs that have important implications for crisis stability: the submarines' alert status, the pre-delegation of launch authority, and the merits of continuous-at-sea deterrence.

Alert Status: One of the main concerns foreign observers have is that China may arm its SSBNs with nuclear warheads during patrols, as other nuclear powers do. To complicate matters, the term "alert" has different meanings in the naval jargons of different countries. In the United States, for instance, alert is a narrow, technical term that refers to precise operational requirements: an alert SSBN is submerged, undetected, able to receive communications, in range of targets, and has readied its weapons systems to respond on short notice.[34] In U.S. terminology, an alert SSBN is at the highest possible level of readiness.

[K]ey operational issues pertaining to China's SSBNs . . . have important implications for crisis stability: the submarines' alert status, the pre-delegation of launch authority, and the merits of continuous-at-sea deterrence.

By contrast, in Chinese official documents, such as defense white papers, the word "alert" is most commonly used in the terms "alert level" or "alert status" to describe general efforts to increase the readiness of the country's nuclear forces. In Chinese terminology, nuclear forces that have been alerted are not necessarily at the highest level of combat readiness. This report uses the term in the second relative sense.

Existing open-source information about the alert status of Chinese nuclear weapons is mostly about the country's land-based missiles. Currently, China is believed to maintain a low alert level for its land-based nuclear missiles during peacetime, with missiles and warheads stored separately.[35] Beijing's 2013 defense white paper, for example, indicates that China keeps the readiness of its nuclear forces at a "moderate level" and will only raise the alert level "when the country faces a nuclear threat."[36] Meanwhile, the Chinese government has promoted international efforts to reduce the alert level of other states' nuclear weapons.[37] China is proud of its posture, which enhances its image as a responsible nuclear weapon state.

It is standard practice for British, French, U.S., and Russian SLBMs alike to be armed with nuclear warheads when they are conducting patrols, even in peacetime. Whether China

follows this practice is unclear.[38] If it does, Chinese SLBMs armed with nuclear warheads would represent a major departure from long-standing Chinese policy, but there would be some practical advantages to such a posture. Not least of these advantages would be the ability to sidestep during a crisis the logistical and security challenges of transporting warheads to previously unarmed SSBNs at sea or having the SSBNs sail back to port to pick up the warheads. Such activities may be detected by an enemy and risk being misinterpreted as preparations for nuclear first use. Also, loading an SSBN with missiles and warheads would take time that might not be available during a rapidly developing crisis. Furthermore, some U.S. and British experts believe that if SSBN crews are not trained frequently to operate with missiles during peacetime, they might be prone to making mistakes in a high-pressure crisis.[39] This concern may influence the thinking of Chinese strategists as well.

Despite these considerations, however, putting Chinese sea-based nuclear weapons on relatively high alert during peacetime patrols would have implications for strategic stability. Doing so would likely create an impression among foreign observers that China could conduct a more rapid surprise nuclear attack in the future. This perception could increase an enemy's incentive to attack Chinese SSBNs early in a serious conflict to preempt the possibility of China using nuclear weapons first. Moreover, the U.S. political scientist Scott Sagan has pointed out that in complex engineered systems like nuclear weapons, there are (almost inevitably) some risks of accidents.[40] Maintaining a high alert level for SSBN forces would come at the expense of safety and security, potentially making technical or operational incidents more likely to occur and more likely to carry serious consequences.

Launch authority: A second operational issue that has implications for crisis stability is whether or not China should pre-delegate launch authority for its nuclear missiles to submarine commanders. The question stems from the reality that maintaining reliable communication channels with SSBNs at sea is difficult. If communication between a submarine and a country's national command authority were to be jeopardized, the danger of an unauthorized SLBM launch could increase.[41]

A lack of clarity exists on this point in China's case, partially because there is a debate about which PLA branch is responsible for operating and employing the country's sea-based nuclear weapons. A close reading of China's 2013 defense white paper implies that the PLA Navy, not the Second Artillery Force, was responsible for Chinese SLBMs at that time.[42] Presently, some military commentators have suggested that the PLA Rocket Force is now responsible for all Chinese land-based, sea-based, and air-delivered nuclear weapons.[43] The PLA Rocket Force is a newly established service branch that replaced the Second Artillery Force in January 2016, as a result of military reforms enacted by Chinese President Xi Jinping's administration.

There is, however, no persuasive evidence that SSBNs have become part of the Rocket Force. Irrespective of which service is responsible for China's SSBNs, the country's policy remains

that all nuclear forces are under the direct command of the Central Military Commission. The military service branches have no authority to issue launch orders to nuclear forces during peacetime.[44] The challenge posed by SSBNs is that the technical difficulty of maintaining highly reliable communication channels could create incentives for the national leadership to consider pre-delegating launch authority during a crisis.

Generally speaking, there are two potential approaches to managing launch authority for SSBNs. One option is to permit the submarine to launch its missiles only after receiving an explicit order from the national command authority. In the case of the United States, only after the president has issued a launch order would the code to unlock the safe containing the launch keys be transmitted to submarine officers. Without this code, the submarine crew cannot launch the missiles.

The other option is to grant some authority to the submarine crew to launch SLBMs in extreme circumstances. Like its U.S. counterpart, the national command authority of the UK has the ability to transmit launch order to SSBNs. If, however, UK submarine officers were to become convinced—through various prescribed tests—that the UK had been destroyed in a conflict, the captain could act according to a pre-written letter from the prime minister previously locked in a safe. This arrangement leaves the crew some latitude to decide when to act on the basis of what is contained in this letter of last resort, and it makes it theoretically possible that the prime minister's letter may give the submarine captain some flexibility about whether to launch missiles based on his or her own judgment of the situation.[45]

For Beijing, the question of launch authority is closely tied to the reliability of the country's communications system. China has made progress on enhancing the reliability of its means of communicating with SSBNs in recent years, despite the questions that the U.S. government and some experts have raised about the system's sophistication.[46] If China continues to prioritize the modernization of this system, if Beijing feels confident in its ability to reliably communicate with SSBNs at sea in a timely manner, and if the country feels confident in its ability to protect its top leadership in a crisis, then China may be able to avoid pre-delegating launch authority to SSBN commanders. This would reduce the risk of unauthorized missile launches. An important consideration is China's degree of concern that, in a conflict, an enemy might interfere with its SSBN communications. Such concerns could prompt China to pre-delegate some launch authority to SSBN commanders. If that were the case, enemy interference with SSBN communications could, in a conflict, increase the risk of an unauthorized launch.

Patrol strategy: A third decision with implications for crisis stability is whether or not China chooses to maintain a so-called continuous-at-sea deterrence. This posture requires a country to maintain at least one SSBN in patrol areas at all times, an approach that has been adopted by France, the UK, the United States, and Russia (although the practice

lapsed in Russia for a while after the fall of the Soviet Union). The advantages and disadvantages of this approach, however, have not been systematically debated in the open-source Chinese literature.

Examining the patrol practices of other nuclear powers is instructive. The United States keeps as many SSBNs as possible on patrol.[47] This posture ensures that a very large number of U.S. nuclear weapons would survive even a sudden, unexpected, large-scale, nuclear first strike. However, the utility of this strategy in peacetime is highly questionable, given the extremely low chances of an out-of-the-blue first strike—without any reason or warning—apart from a deep crisis or conflict. In addition, this posture is very expensive to implement, as it requires not only a large number of SSBNs but also a highly sophisticated logistics and maintenance system to maximize the SSBNs' availability. Moreover, the United States assigns two crews to each nuclear-armed sub. By contrast, the UK and France—each of which have a smaller force of four SSBNs—have adopted the more modest approach of keeping only one SSBN on patrol at all times. Even so, questions are frequently raised—particularly in the UK—about whether continuous-at-sea deterrence is really necessary, especially given that many British analysts argue that their country faces no existential threat.[48]

Some Chinese military commentators assume that Beijing's ultimate goal is continuous-at-sea deterrence. Indeed, the fact that China has built at least four 094-type SSBNs seems to confirm such speculation. However, there has not yet been any open discussion about whether Beijing should adopt this posture. China has long believed that a nuclear war between nuclear weapon states, let alone an out-of-the-blue surprise nuclear strike, is unlikely.[49] If this belief is correct, China may be able to safely maintain the credibility of its nuclear deterrent without continuous SSBN patrols during peacetime.

That said, the downside of intermittent patrols is that submarines could be exposed to preemptive strikes—even conventional preemptive strikes—while in port. To mitigate this risk, China would need to quickly deploy its SSBNs at the first sign of a serious military crisis. If, however, an adversary were to detect these SSBN movements, it could misinterpret them as aggressive and consequently feel pressured to take the escalatory step of preempting an imminent attack. Additionally, China would need to develop effective crew training and equipment maintenance mechanisms to compensate for the lack of training opportunities intermittent patrols would offer compared with those of a continuous-at-sea deterrent.

CHINESE SSBN FLEET GROWTH AND ARMS RACE STABILITY

The effect of China's nuclear-armed submarines on strategic stability will also be felt in terms of arms race stability. This impact will largely be a product of the future growth of China's SSBN fleet and other complementary military assets, the growth of rival naval assets, and (most importantly) both sides' perceptions of how these procurement decisions affect the overall military balance.

Whether or not China's SSBNs will fuel an arms race is not determined entirely by whether Beijing's primary intention is simply to maintain the status quo by preserving the viability of its overall nuclear deterrent. What matters is how other players interpret Chinese efforts. If they believe that China's intentions are not benign and that the growth of Chinese nuclear capabilities may enable Beijing to behave more assertively, they might react by significantly building up their own capabilities and investing in new countermeasures. China's deployment of SSBNs and supporting general-purpose forces may, therefore, quickly change its overall military capabilities and hence the calculations that foreign analysts make about China's strategic intentions, potentially contributing to a new round of nuclear and conventional arms competition.

When assessing the potential growth of China's nuclear arsenal, it is worthwhile to establish an approximate baseline of the country's current nuclear stock. One widely cited assessment puts China's existing nuclear stockpile at around 206 warheads, excluding warheads on SLBMs.[50] This stockpile includes only about fifty-two ICBM launchers that could potentially launch missiles against the continental United States.[51] If China succeeds in fielding between five and eight 094-class SSBNs in the near future, as some senior U.S. officials and experts seem to predict, China will add to its arsenal between sixty to ninety-six strategic missile launchers capable of striking the continental United States, as each such submarine carries twelve SLBM launchers. To be sure, it is unlikely that all Chinese SSBNs could be in their patrol areas, ready to launch missiles against the United States, at the same time.[52] There is no available information about whether China's SLBM warheads would come from new stock or be diverted from possible existing reserves. This means that it is not yet possible to conclude how much China's overall warhead stock will grow as a result of the addition of the SSBN capability.

If [other countries] believe that China's intentions are not benign . . . they might react by significantly building up their own capabilities and investing in new countermeasures.

There is little doubt that this new SLBM strike capability will affect threat perceptions in foreign countries, especially the United States. Some U.S. officials and experts are already alarmed by what they see as a rapid increase in Chinese nuclear capabilities and potential future developments.[53] The recently revealed ship assembly facility of the Bohai Shipbuilding Heavy Industry Company further contributes to such concerns.[54] This new facility is often described by Chinese military commentators as the largest of its kind in the world; it is reportedly capable of working on five to six nuclear submarines simultaneously. *Cankao Xiaoxi*—China's largest newspaper by circulation, which is published by the official Xinhua News Agency—cited foreign reports stating that this "giant" facility will be used to build China's most advanced SSBNs and SSNs on a scale unmatched by any other state.[55] Although ques-

tions have been raised about the accuracy of these reports,[56] there is a widespread perception that this facility could contribute to a quick future buildup of China's SSBN fleet.

The United States may feel less threatened if it believes that China's SSBN growth is motivated exclusively by the desire to secure its second-strike capabilities. However, if Washington suspects that the program is actually driven by nondefensive goals—such as rising nationalist sentiment, a desire to catch up with the other major powers, or bureaucratic interests—that Washington cannot predict or influence (or that Washington must at least hedge against this possibility), the existing security dilemma between the two major nuclear powers would be exacerbated in ways that could lead to more intensive arms competitions.

Historically, China's decision to start an SSBN program was very much motivated by a desire to acquire capabilities similar to those of other major nuclear powers.[57] China's top leadership decided to start developing a sea-based nuclear weapon capability in 1958,[58] even before the country's first nuclear test in 1964. Moreover, at that time, China's poorly equipped military was in dire need of even the most basic military hardware. Given the circumstances, the leadership's decision to pursue a highly complex weapons system, like a nuclear missile submarine, suggests that it was driven by a desire to follow a trend in military development led by major world powers.

Indeed, during the 1960s and 1970s, the lack of urgency in China's SSBN development suggests that it was not driven by a pressing military need. The Defense Science and Technology Commission only developed specific operational requirements for China's first nuclear attack submarine in 1966, eight years after their decision to acquire the submarine. Research and development into China's first ballistic missile submarine was similarly delayed by a lack of clear operational requirements.[59] For at least three decades after the decision to start the program, Chinese nuclear submarines were a lower priority than land-based missiles and other military programs. When the country's defense budget was particularly tight in the early 1960s, the nuclear submarine program was discontinued until 1966. Even after that, for quite a long time up until the mid-1990s, the program received only moderate political attention and financial support.[60]

In recent decades, even as China has made the development of SSBNs a higher priority, international trends have continued to strongly influence the thinking of Chinese strategists. They take note that every other nuclear weapon state that has signed on to the Nuclear Non-Proliferation Treaty (NPT) has increased the role of sea-based nuclear weapons in its nuclear posture, and they conclude that "from the global perspective, the proportion of sea-based nuclear capability in national nuclear deterrent systems will continue to rise."[61] For example, they point out that sea-based nuclear weapons already represented 60 percent of all U.S. deployed nuclear warheads by 2015. This figure is expected to have risen to 70 percent by 2018. Chinese analysts expect the equivalent figure for Russia to increase from 23 percent in 2015 to 57 percent in 2020.

Crucially, Chinese strategists see that similar developments are occurring across all "mid-level nuclear weapons states," a group that consists of France and the UK and to which they believe China belongs. They point out that "establishing a minimum underwater nuclear capability is a common understanding among mid-level nuclear weapons states," which further reinforces the belief that "nuclear submarines armed with strategic nuclear missiles are the most ideal type of nuclear retaliation capability."[62] In short, Chinese analysts generally perceive SSBNs as befitting a country of China's stature.

In other words, the urgency and necessity of China's development of an additional sea-based nuclear capability has not yet been publicly demonstrated. To be sure, there is increasing recognition in China that SSBNs can play a critical role in strengthening its nuclear deterrent in the face of a new geostrategic environment and technological threats. In particular, many Chinese experts worry about the credibility of a nuclear second-strike capability based solely on land-based ICBMs given advances in U.S. missile defense and conventional precision strike capabilities. Nonetheless, there has been little authoritative research—that is openly available, at least—about the extent to which U.S. missile defense and conventional precision strike capabilities may undermine the effectiveness of Chinese land-based ICBMs in the foreseeable future.

Additionally, the availability of new financial and material resources has presumably played a role in the rapid growth of China's SSBN fleet. Decades of rapid economic development have, for the first time, offered the PLA opportunities to procure military capabilities that it had only dreamed about before. China's gradual military transformation, including a reduced emphasis on the traditionally central role of ground forces, provides an opportunity for the air force and navy to rapidly expand their missions and capabilities. Some foreign analysts suspect that the parochial interests of China's different military services and the defense industry have started to become a more important factor in driving the country's military investments, including nuclear modernization.[63] The rapid development of China's SSBN fleet may reflect this growing complexity in military procurement plans.

Ultimately, Chinese decisionmakers face the challenge of separating practical security needs from the nationalistic desire to win more international respect and other nonsecurity considerations.

Furthermore, there are increasingly frequent calls in some nationalistic Chinese media outlets for China not to "hesitate to strengthen strategic nuclear capabilities" and to gradually match the nuclear capabilities of the United States.[64] This development is fairly new; in the past, it was rare to hear such open advocacy for China to greatly expand its nuclear arsenal. Worryingly, such radical newspaper editorials have received overwhelming support from readers—based on reader feedback, at least. This raises the concern that a growing sense

of nationalism among parts of the Chinese public may influence the future nuclear policy choices China's leaders make. Nationalist sentiment is apparent, too, in an underlying belief that China needs more powerful nuclear forces not just because of military considerations but because such capabilities would win China international respect and contribute to strategic stability by making other countries less likely to pick a political fight with China.[65]

At the official level, China has been more willing to place its SSBNs in the domestic and international spotlight in recent years. In October 2013, China's most important official media outlets—including China Central Television (CCTV), the *People's Daily*, the Xinhua News Agency, and the *PLA Daily*—all simultaneously released many high-profile reports and stories about the country's SSBN fleet. This was the first time that Beijing officially showed off its sea-based nuclear capabilities through a massive media campaign.

Afterward, stories and commentary on the development of China's SSBN fleet began to appear more frequently in both official and unofficial media reports. Chinese military experts often comment on this and related topics on CCTV channels, which further raises public awareness and interest. Due to the high level of secrecy regarding submarine operations, media coverage of Chinese SSBNs is not as intense as that surrounding, say, the country's aircraft carrier fleets, but the former topic is receiving increasing levels of public attention. As a result, a considerable part of the general public sees the program as an important symbol of China's growing hard power and international status.

Ultimately, Chinese decisionmakers face the challenge of separating practical security needs from the nationalistic desire to win more international respect and other nonsecurity considerations. As U.S. scholar Charles Glaser points out, when a state engages in an arms race in response to an external threat, that state is acting rationally. By contrast, if the causes of an arms race are domestic, the state is acting suboptimally, and the consequences are likely to be more negative.[66] If China allows nationalistic sentiments to induce it to build a massive sea-based nuclear capability beyond any practical security needs, this could raise doubts in foreign countries about Beijing's strategic intentions and contribute to an unnecessary, damaging strategic arms competition.

THE SURVIVABILITY OF CHINA'S SSBNs AND STRATEGIC STABILITY

OF ALL THE ASPECTS of China's SSBNs, their overall survivability is the most important factor in determining their impact on strategic stability. Survivability refers to an SSBN's capability—through stealth, supporting forces, and other means—to remain safe from an enemy's ASW efforts and, if needed, deliver SLBMs through an enemy's missile defenses to strike their targets.

SSBN survivability has a significant impact on crisis stability. If China were concerned that its SSBNs could be destroyed, it would have a greater incentive to use the nuclear weapons onboard early in a conflict—even at the first sign of a preemptive strike by an adversary—before the weapons were lost. Moreover, concern about SSBN survivability could lead China to employ pro-SSBN forces (friendly general-purpose forces used to protect SSBNs) in aggressive ways to counter an enemy's ASW capabilities, raising the risk of a conventional military conflict. Because such a conflict would be fought in the presence of SSBNs, it would unfold under the nuclear shadow and carry a greater risk of escalation.

SSBN survivability also seriously affects arms race stability. China's accelerated investment into its SSBN program in recent years has been partially driven by concerns about the overall credibility of its nuclear deterrent. If Beijing feels its existing SSBN fleet falls short of what is required for a credible deterrent, it will likely increase its investment and build more and better SSBNs. These actions could, in turn, increase threat perceptions in other countries and intensify the existing competition. The arms competition resulting from Chinese efforts to protect its SSBNs and from other countries' countermeasures could extend into the domain of conventional forces, including even unmanned vessels.

THE INHERENT SURVIVABILITY OF CHINESE SSBNS

China's expectation that its SSBNs can help enhance the credibility of its second-strike capability is based on the assumption that the SSBNs are—or at least can become—highly survivable. China has undertaken great efforts in recent years to augment the survivability of its nuclear-armed submarines, although there are still real challenges to ensure that the submarines remain undetected while they are operating.

There is very limited information available today about how quietly Chinese SSBNs can operate, but international and Chinese experts generally agree that China's 094-class SSBN is relatively noisy. According to a 2009 assessment by the U.S. Office of Naval Intelligence, this SSBN is noisier than the Russian Delta III SSBN, which was developed in the 1970s.[67] Wu Riqiang, a Chinese scholar at Renmin University, has used open sources to estimate an answer. He found that the low frequency noise level (100 hertz)—a widely used indicator of submarine quietness—attributed to China's 094-class SSBN is significantly higher than that of the Russian Delta IV SSBN. For the time being, at least, the Delta IV forms the backbone of Russia's SSBN fleet and is noisier than the United States' current generation of Ohio-class SSBNs.[68]

Some of the basic design features of the 094 class seriously limit its potential to become a genuinely quiet submarine.

In some respects, the design of China's submarines may be refined over time. Notably, when China was developing its first-generation nuclear submarines, it built a prototype vessel first, as quickly as possible, and then improved the design for subsequent vessels.[69] China's leadership may be adopting the same strategy for its second-generation submarines.[70] While the first vessel of the 094 class may be relatively noisy, it is possible, therefore, that subsequent vessels of the same class may perform better. In fact, recent photos of a new 094-class SSBN revealed some new design and manufacturing features; these changes seem so significant that some Chinese analysts have described the boat as belonging to a new class: the 094A.[71] These submarines may become more survivable than the original 094 class, particularly in China's shallow coastal waters (where detecting quiet submarines is particularly challenging).

That said, some of the basic design features of the 094 class seriously limit its potential to become a genuinely quiet submarine. The submarine's large missile compartment, the numerous flood openings in the casing, and the skewed propeller (among other basic design features) make it very difficult to significantly reduce the submarine's noise level.[72] Indeed, Russia and Western states succeeded in developing quiet SSBNs by making noise reduction a fundamental driving parameter of their design and construction. By contrast, China still has some way to go in terms of improving its submarine technology and obtaining operating experience.

To make matters worse, China's SSBNs may be even noisier than Wu concluded, given certain operating parameters. His assessment that the 094-class SSBN is too noisy to be survivable was based on the average ambient low-frequency noise level in the shelf region of the northern South China Sea. However, ambient noise in that region is usually much higher than in deep ocean water. Consequently, the detection range of the same SSBN in deep ocean water would be much longer. In other words, China's SSBNs would be less survivable in deep ocean water than in shallow coastal waters.

And there is another reason that Chinese SSBNs may be even noisier during patrols than Wu's assessment indicates. Wu focused on noise at very low speeds of around 4–8 knots (approximately 4–9 miles per hour). Most Chinese experts claim that SSBNs usually operate at such low speeds in their patrol areas to avoid cavitation—a form of noise generation involving the collapse of air bubbles created by a propeller. However, other Chinese experts assert that, even in patrol areas, SSBNs usually operate at speeds of around 15–16 knots (or about 17–18 miles per hour), much higher than the cavitation threshold speed of about 8 to 10 knots (or roughly 9–11.5 miles per hour).[73]

Despite such limitations, there are ways for China to maximize the deterrent value of its existing SSBNs.

Another factor affecting the survivability of Chinese SSBNs is their maximum operating depth. Generally, the deeper underwater a submarine is located, the weaker its acoustic signature is, making it more difficult to detect. Moreover, deep water offers a better operating environment for the submarine's own sonar, enhancing its ability to detect threats.[74] The survivability of China's SSBNs may, therefore, be further reduced by reported limitations on their capability to dive deeply.[75]

Despite such limitations, there are ways for China to maximize the deterrent value of its existing SSBNs. Although the 094 class may be too noisy to be truly survivable in open-ocean patrols, there is a good chance that it can operate relatively safely in coastal waters. If China uses general-purpose military forces to protect its SSBNs in these regions, their survivability would be further enhanced. Under this approach, the SSBNs would remain safe in China's coastal waters and only seek to break out into the Pacific Ocean if a crisis occurred, so that their JL-2 SLBMs could reach the U.S. homeland.

In any case, the value of 094-class SSBNs to China may not be exclusively a matter of extant military capabilities. When discussing the role of China's first-generation nuclear submarines, Chinese strategists have emphasized that the main objective was to acquire a baseline nuclear submarine capability even if it was somewhat barebones before later focusing on improving technological sophistication. Moreover, nuclear submarines serve as "schools and labs" of sorts for the Chinese navy in the sense that they help China "gain experience operating large and complex equipment" and "train next-generation sailors and technicians."[76]

In a similar vein, even though China's second-generation SSBNs are beginning to embark on deterrence patrols, a major part of their purpose may still be to provide their crews with operational experience.[77]

In the long run, Chinese analysts are optimistic that the country's future SSBNs will be sufficiently quiet to be militarily effective. They point to evidence that China has been conducting research on a range of new technologies such as pump-jet propulsion and high-temperature, gas-cooled nuclear reactors, and they predict that these new technologies will soon be incorporated into new submarines.[78]

In May 2017, a CCTV broadcast highlighted the achievements of Rear Admiral Ma Weiming, an academic at the Chinese Academy of Engineering and the director of the Power Electronics Research Institute at the PLA Naval Engineering University. On the CCTV program, Admiral Ma claimed that China's shaftless, rim-driven, pump-jet technology is more than ten years ahead of that of the United States; moreover, he claimed that the technology is designed for China's "next-generation nuclear submarine" but is already being used in some areas now.[79] Given that China's nuclear submarine propulsion technology has lagged considerably behind that of other major powers for the past several decades, questions were raised about the credibility of this bold claim. That said, if China has made a technological breakthrough, it may now be able to quickly and significantly increase the quietness and thus the survivability of its SSBNs.

THE SURVIVABILITY IMPLICATIONS OF OPEN-OCEAN DEPLOYMENT

In addition to the structural design of SSBNs, the manner in which these vessels are deployed is another important factor for determining their survivability. Internal Chinese discussions focus on two main potential deployment strategies. One approach, similar to the one the United States employs, is to have submarines conduct patrols in the open ocean. When used in this way, SSBNs must remain quiet enough to rely primarily on their own stealth capabilities to transit to the patrol area and stay undetected during the patrol period.[80] The second strategy, reminiscent of Soviet policy in the later years of its SSBN operations, is to deploy SSBNs to designated areas (termed bastions) in coastal waters. Within these bastions, SSBNs can be protected from advanced enemy ASW capabilities by general-purpose forces.[81]

The available evidence suggests that Chinese SSBNs are not yet conducting regular open-ocean patrols but that Beijing may already be preparing for a future in which they do. Indeed, going forward, China has strong incentives to have its SSBNs patrol in the open ocean—in the Pacific, in particular; many Chinese strategists believe this is China's long-term goal.[82] Some senior PLA scholars have argued that open-ocean SSBN patrols are a "necessary capability" in the long-term future.[83]

One major reason Chinese analysts assume that Beijing hopes to eventually conduct regular open-ocean patrols is because of the limited range of the JL-2 ballistic missiles that its SSBNs carry (7,200 kilometers).[84] Given that, JL-2 missiles cannot reach the continental United States if launched from Chinese coastal waters. At a minimum, Chinese SSBNs would have to sail into the Western Pacific to target the U.S. mainland with this missile. If putting the continental United States in missile range is a primary goal of the Chinese military, the country's leadership, therefore, has a strong incentive to send its 094-class SSBNs into the open ocean as soon as possible.

As mentioned previously, the operational future and potential range of China's next-generation JL-3 SLBM remain uncertain. The most recent U.S. Worldwide Threat Assessment report, released by the director of national intelligence on February 13, 2018, states that "the PLA Navy continues to develop the JL-2 submarine-launched ballistic missile."[85] This may imply that the next-generation JL-3 will not become operational in the immediate near-term future.

In addition to the structural design of SSBNs, the manner in which these vessels are deployed is another important factor for determining their survivability.

In addition, conducting patrols in the open ocean would give China's SSBNs much greater flexibility in terms of patrol areas and launch positions. Chinese experts emphasize the importance of large patrol areas and the ability to surprise an enemy by operating from unpredictable launch locations as ways to greatly enhance deterrence.[86] Furthermore, Chinese SLBMs launched from the Pacific would have shorter flight times and more unpredictable attack trajectories, compared to ICBMs launched from mainland China or SLBMs launched from Chinese coastal waters, so Pacific-launched SLBMs would enjoy an enhanced ability to penetrate U.S. missile defense systems.

Open-ocean patrols have other strengths as well. From a cost-saving perspective, China should have strong incentives to conduct open-ocean patrols. Submarines that are sufficiently quiet to survive and operate in open oceans on their own reduce operating costs significantly, compared to those that require protection by friendly forces. U.S. Ohio-class SSBNs, for example, are capable of safely transiting from their home ports to patrol areas in the open ocean and then conducting patrols with a minimum level of friendly force protection. By comparison, for part of the Cold War, the Soviet Union assigned a large portion of its navy's general-purpose forces to protect SSBNs within bastions near its own coast, leaving the navy with insufficient resources for other operations.[87] One final advantage of open-ocean patrols—as Chinese experts, including retired Rear Admiral Yin Zhuo, have pointed out—is that China's coastal waters, especially the East China Sea, are not deep enough (about 100 meters deep on average) for China's nuclear and conventional submarines to conduct proper training; he posits that the country's submarines therefore naturally need to go to the Pacific.[88]

For its part, China's anti-access area denial (A2/AD) capabilities also face challenges in creating a highly reliable SSBN safe zone in its coastal waters. China has reportedly developed and deployed various A2/AD capabilities, designed (in part) to keep large enemy surface ships away from its coast. However, Chinese capabilities to hinder the operations of enemy submarines and aircraft, which could pose a serious threat to China's SSBNs, are less sophisticated.

The downside of open-ocean patrols is that very quiet submarines are required. After a submarine arrives in its patrol area, it can travel very slowly to minimize noise and hence the risk of detection. It must, however, first transit from its port to the patrol area, and, if it is to do so in a reasonable amount of time, it needs to travel at somewhat high speeds. During this period, the submarine tends to be noisier and so more vulnerable to detection.

China's relatively noisy SSBNs would face significant challenges transiting undetected to the Western Pacific. In transiting from the South China Sea or the Yellow Sea to the Pacific Ocean, Chinese submarines have to sail through channels adjacent to enemy-controlled territories in the so-called First Island Chain—a series of archipelagos off the East Asian continental mainland, including Japan, the Ryukyu Islands, China's Taiwan, and the northern Philippines.[89] Such channels are closely monitored by the United States, Japan, Taiwan, and often the Philippines. Due to the difficulty of making undetected SSBN transits, Chinese strategists have been particularly emphatic about the importance of noise control.[90]

Apart from seeking to develop quieter submarines, there are alternative approaches China might employ to enable its SSBNs to reach the Western Pacific safely. For instance, according to some independent Chinese analysts, Beijing could use surface vessels to escort an SSBN to the Western Pacific, and then the SSBN could break loose from the fleet and start to patrol independently.[91] While it is impossible to verify whether the Chinese navy has actually adopted this tactic, it is worth noting that the frequency with which Chinese surface fleets have been sent into the Western Pacific to conduct training missions has increased considerably in recent years.[92] Such flotillas have included submarine rescue ships on a more frequent basis. It is probable that one or more SSNs were included in these training missions. In the future, after these SSNs have mastered this operation, China may become confident that its SSBNs can try to do the same.

THE SURVIVABILITY IMPLICATIONS OF BASTION DEPLOYMENT

In the long run, if China's future SSBNs become sufficiently survivable in the open ocean, they may be deployed periodically on the open seas. That said, depending on how successful such open-ocean deployment turns out to be, China may still choose to also maintain the bastion approach, not least as a backup option. Many analysts seem to think that Beijing currently favors the option of deploying SSBNs in the more protective setting of bastions in

its coastal waters as an alternative to open-ocean patrols. Many U.S. and Chinese analysts speculate that China is mirroring the Soviet practice from the 1970s and 1980s of creating such a bastion in part of the South China Sea to protect its SSBNs.[93] Despite some potential challenges, it appears that Chinese experts generally agree that the bastion strategy is a reasonable one for Beijing to adopt, especially in parts of the South China Sea. Given the large submarine base China has built near Sanya on Hainan Island, Beijing clearly intends to use the South China Sea as an important operational area for its SSBN fleet.

Although the government has not officially used the term bastion, Chinese military analysts have widely assumed that the state is systematically implementing this strategy. Indeed, there are clear advantages to this approach. The northern and central parts of the South China Sea are deep enough for large nuclear submarines to operate. The temperature and salinity of the water there create natural barriers for sound propagation and submarine detection. The presence of busy civilian shipping lanes further complicates the underwater sound environment and helps Chinese SSBNs avoid detection. Moreover, Chinese SSBNs in the South China Sea can readily receive surface and aerial protection from China's South Sea Fleet and other general-purpose forces. China's growing power projection capability and newly built dual-use infrastructure on Hainan, the Paracel Islands, and the Spratly Islands are further advancing its capacity to protect SSBNs deployed in nearby waters.

Many analysts seem to think that Beijing currently favors the option of deploying SSBNs in the more protective setting of bastions in its coastal waters as an alternative to open-ocean patrols.

Aside from the South China Sea, it is possible that China's SSBNs may also use parts of the Yellow Sea and the East China Sea as secondary patrol areas. China has an important submarine base near Qingdao in Shandong Province, and satellites have often spotted Chinese nuclear submarines, including SSBNs, in its vicinity.[94] Although the relatively shallow waters of the Yellow and the East China Seas are not ideal for nuclear submarines, operating SSBNs from these waters would make their locations less predictable and prevent the United States from concentrating its strategic ASW efforts in one area.[95]

A bastion strategy also has logistical advantages over open-ocean patrols. Chinese SSBNs operating in bastions do not need to make long transits from their home ports to reach patrol areas in coastal waters, greatly reducing the risks to SSBNs in transit. In addition, the proximity of patrol areas to the mainland and the presence of friendly platforms considerably simplify the challenges of maintaining effective and reliable command, control, and communications arrangements. Moreover, deploying SSBNs in coastal waters would simplify logistics, especially resupply, during a protracted crisis. If an SSBN required critical supplies while on patrol in coastal waters, it could be serviced by surface ships or aircraft

without sailing back to a port. This vertical form of resupply could be accomplished rapidly and would enable the SSBN to remain on patrol continuously.[96] By contrast, Chinese capabilities to provide similarly effective logistical support to vast areas of the Pacific will likely remain limited, at least for the time being.

In spite of these advantages, there are important challenges to the effectiveness of Beijing's bastion strategy—challenges that Moscow did not face when it employed a similar tactic. First, the limited range of the JL-2 SLBM reduces the deterrent value of basing SSBNs in Chinese coastal waters. While the JL-2 may be able to strike Guam or Hawaii from such waters, it could not strike the continental United States. As a result, in a serious crisis, China might well decide to send its SSBNs out to the Western Pacific to bring the U.S. mainland within range.

Second, China's most likely SSBN bastions would be located in far more crowded waters. Unlike the areas where the Soviet Union (and later, Russia) set up its submarine bastions—in relatively isolated coastal waters, such as the Sea of Okhotsk and the Kara Sea—there is extensive commercial shipping in the South China, East China, and Yellow Seas. Moreover, the South China Sea, in particular, is surrounded by a number of other countries, making it likely that foreign navies would be present during both peacetime and a crisis. The relatively complex underwater sound environment in the South China Sea makes China's submarines easier to hide, but this property also makes it more difficult for China to identify and repel foreign attack submarines.

It can be safely assumed that China's best short-term option for now is to continue operationalizing a bastion strategy for its SSBNs in its coastal waters.

A further complication is that the United States and its allies have critical sea lines of communication (SLOCs) located in the South China Sea—the same area where China is most likely to build its SSBN bastion. The United States and its allies, therefore, have strong incentives to deploy attack submarines and other assets to this area to protect these SLOCs. Especially in a crisis or conflict, such attack submarines would inevitably pose a direct threat to Chinese SSBNs operating in the same area, even if the United States did not intend for them to. By contrast, during the Cold War, the SLOCs most important to the United States and its NATO allies were in the North Atlantic Ocean, far to the south of the main Soviet SSBN bastions in the Barents Sea. In short, China faces challenges in protecting its SSBN bastion that the Soviet Union did not.

One final factor China must consider is U.S. missile defenses in the region. The recent deployment to South Korea of an AN/TPY-2 radar—as part of the Terminal High Altitude Area Defense (THAAD) system—has heightened China's concerns about the U.S. missile defense network in the Asia Pacific.[97] Chinese SLBMs launched from the country's coastal

waters—whether JL-2 SLBMs aimed at regional targets or future JL-3 SLBMs aimed at the U.S. homeland—might be a little easier for Washington to intercept than missiles launched from the vast Pacific Ocean. In the case of SSBNs located in coastal waters, the United States would know the general area from which a Chinese SLBM might be launched and could concentrate radars and other sensors there to ensure timely detection and accurate tracking. The United States already has two AN/TPY-2 radars deployed in Japan, in addition to the one in South Korea. These assets could help detect and track Chinese SLBMs launched from Bohai Bay, the Yellow Sea, and the East China Sea.[98] Meanwhile, the PAVE PAWS early warning radar in Taiwan could help detect SLBMs launched from the South China Sea.[99] Taiwan denies that it shares the radar data with the United States, but Chinese analysts are skeptical of this claim.

To complement these land-based missile defense assets, Washington also has a surge capability to deploy a large number of Aegis-equipped ships armed with SM-3 ballistic missile interceptors to China's coastal waters in a crisis. For some time, the United States had intended to develop a variant of the SM-3 interceptor capable of conducting ascent-phase interception against some ICBMs or SLBMs.[100] Although the Obama administration in 2013 canceled the development of this interceptor, the SM-3 IIB, some Chinese assessments have concluded that the SM-3 IIA interceptor (which is expected to be deployed shortly) might be capable of intercepting Chinese SLBMs launched from China's coastal waters.[101]

These potential challenges to the survivability of Chinese SSBNs and SLBMs even in coastal waters notwithstanding, it can be safely assumed that China's best short-term option for now is to continue operationalizing a bastion strategy for its SSBNs in its coastal waters. This approach, while not officially announced, likely will continue to form the backbone of China's sea-based nuclear deterrence strategy, at least until some undetermined point in the future when Chinese SSBNs are deemed much more survivable on their own.

U.S. ANTI-SUBMARINE WARFARE AND ITS IMPACT

THE SURVIVABILITY OF Chinese SSBNs and the resulting impact on strategic stability in the Asia Pacific are shaped not only by the structural features and operational practices of China's submarines but also by how the United States and its regional partners respond to China's nuclear submarine fleet. The threat that the ASW capabilities of the United States, Japan, and other U.S. regional allies pose to China's SSBNs has significantly affected their survivability and has important implications for strategic stability. These rival ASW capabilities also have important ramifications for the operational strategy China adopts for its SSBNs and, hence, affect the risks of a conventional conflict and inadvertent escalation as well.

The threat that the ASW capabilities of the United States, Japan, and other U.S. regional allies pose to China's SSBNs has significantly affected their survivability and has important implications for strategic stability.

CHINA'S THREAT PERCEPTIONS

The United States and its allies wield a variety of ASW platforms that could threaten China's SSBNs. These assets include attack submarines, ASW-capable surface ships, maritime ASW aircraft, and surveillance ships that can prepare for and assist in ASW operations. Chinese concerns are exacerbated by continued U.S. freedom of navigation operations off China's coast and the continued reinvigoration of U.S. ASW capabilities.

Geography lends various advantages to the United States' and its allies' efforts to block Chinese SSBNs from patrolling in the Pacific Ocean. The biggest roadblock is the existence of major chokepoints separating China's coastal waters from the Pacific Ocean. Along the First Island Chain, there are only a limited number of waterways—including the Miyako Strait and the Bashi Channel (in the Luzon Strait near the Philippines)—through which Chinese SSBNs can transit. All of these waterways are adjacent to land features possessed or controlled by U.S. allies, so the passages are under close surveillance by U.S. or U.S.-friendly ASW forces.

In fact, some Japanese defense officials used to boast that Chinese submarines would not be able to slip into the Pacific through the Ryukyus, a chain of islands scattered along the north and south of Taiwan, or through the Bashi Channel without being detected by U.S. and Japanese ASW systems.[102] Indeed, there have been cases when foreign countries have reportedly detected Chinese SSNs in transit. In 2004, for example, a Chinese 091-class nuclear attack submarine was reportedly detected by Japanese, Taiwanese, and U.S. ASW platforms as the submarine sailed from the Western Pacific back to China, passing through Japanese waters.[103] Similarly, in January 2018, a Chinese 093-class SSN—which is believed to be considerably quieter than the 091-class SSN, and which may have a noise level similar to that of the 094-class SSBN—was reportedly detected by Japan while it was submerged near the Diaoyu/Senkaku Islands.[104] Notably, Chinese SSBNs face greater geographical constraints today than Soviet SSBNs did during the Cold War. The barrier formed by Greenland, Iceland, and the UK that Soviet SSBNs needed to pass through to reach the North Atlantic Ocean is much wider than the waterways in the First Island Chain.

Geography lends various advantages to the United States' and its allies' efforts to block Chinese SSBNs from patrolling in the Pacific Ocean.

To compound the geographical advantages that China's rivals enjoy, the United States and its allies have significantly augmented their sound surveillance networks in and around the Pacific in recent decades, in the face of increasing Chinese submarine activity.[105] The United States even has reportedly extended its underwater hydrophone systems to the south of the Philippines to connect with islands belonging to Indonesia and, from there, north to India's Andaman Islands.[106] This all-encompassing, seamless network—known as the U.S. Navy's Fish Hook Undersea Defense Line—has the potential to seriously undermine Chinese SSBNs' ability to leave China's coastal waters and sail into the Pacific or Indian Oceans.

Beyond Chinese concerns about detection, the United States could undermine the efficacy of China's sea-based nuclear deterrent by interfering with its command, control, and communications (C3) system. Foreign analysts have long raised doubts about China's ability to maintain reliable communication channels with SSBNs operating in distant oceans.[107]

Conducting long distance communications with a submerged SSBN is challenging, though Beijing has been seeking to improve in this area. Open-source research indicates that China is now capable of communicating with submarines at super low frequencies (SLF) of 30–300 hertz.[108] In 2009, China reportedly completed construction on its first military SLF transmission station and conducted several tests. One year later, a Chinese nuclear submarine successfully received messages from the SLF transmission station, as China became the third country in the world to establish a comparable submarine communications system.

There is some evidence that this system has been effective at enabling Chinese submarine operations far from China's shores. In 2013, a Chinese nuclear attack submarine completed a successful patrol in the Indian Ocean and reached as far as the Gulf of Aden.[109] After that, CCTV reported during an episode of its Military Reports (Junshi Baodao) program that China has established regular patrols of nuclear attack submarines for anti-piracy escort missions near the Gulf of Aden.[110] Where there may be other means of communicating with these SSNs, such as satellites or local surface ships, some independent Chinese analysts have cited such patrols as indirect evidence that China has achieved reliable radio communication with its nuclear submarines at very long distances.[111]

Furthermore, China is believed to be conducting research on extremely low frequency (ELF) radio communications,[112] a technology that would facilitate contact with submarines in very deep water (more than 100 meters) and would further enhance the survivability of Chinese submarines.[113] In addition, an airborne C3 system similar to the U.S. TACAMO (take charge and move out) is thought to be under development.[114] Furthermore, China has long explored the possibility of using satellites for submarine communications.

Jointly, these technologies could provide an increasingly diversified C3 system for Chinese SSBNs. That said, all these communication methods have shortcomings. Airborne systems are vulnerable to air-defense weapons. Submarines must come close to the surface to receive signals from satellites. And ground-based transmitters can be held at risk with high-precision conventional munitions. Such vulnerabilities create potential opportunities for enemy exploitation that must be taken into account.

THE MOTIVATIONS BEHIND AND CHARACTER OF U.S. ANTI-SUBMARINE WARFARE

In light of the vast scope of U.S. and allied ASW capabilities, it is crucial to explore the motivations and strategy that shape how Washington and its partners employ these assets. To put the discussion into perspective, it is worthwhile to first distinguish between two types of operations for countering enemy submarines. Strategic ASW aims to counter an adversary's SSBNs. By contrast, tactical ASW is directed at a foe's attack submarines or other general-purpose submarines. In wartime, strategic ASW would involve intentionally tracking and potentially attacking an adversary's SSBNs.

It is important to use the qualifier "intentionally" because, during an unexpected encounter with an enemy submarine, it may be unrealistic to expect a naval commander to try to determine whether the enemy submarine is carrying nuclear missiles before launching an attack. During peacetime, if an enemy SSBN is encountered by chance, it is common to try to trail it and gather intelligence. By contrast, strategic ASW during peacetime would involve efforts to deliberately seek out enemy SSBNs even if there is no other reason to expect one to be operating in a given area.

China's view is that the United States and its allies should not conduct strategic ASW against its SSBNs because doing so would undermine China's confidence in its SSBN forces' survivability and, hence, have a negative effect on strategic stability. Much of the U.S. policymaking community seems to agree that deliberately targeting Chinese SSBNs with its ASW capabilities would be counterproductive. Indeed, the mainstream views in Washington (at least among analysts) are that the United States should not seek to undermine China's second-strike capability and that the U.S. military very likely does not and will not have the capability to fully neutralize China's strategic deterrent. The 2009 Nuclear Posture Review and the Ballistic Missile Defense Review, which set out Obama administration policy, both explicitly stated that the United States is committed to maintaining strategic stability with China.[115] Beijing understands this statement to mean that Washington has essentially committed not to seek to undermine China's second-strike capability. To some extent, this understanding has since served as an important foundation for a stable U.S.-China nuclear relationship.

Much of the U.S. policymaking community seems to agree that deliberately targeting Chinese SSBNs with its ASW capabilities would be counterproductive.

Policy documents from the Trump administration appear to have softened that stance somewhat, but these documents do not convey an overt intention to upset strategic stability vis-à-vis China. The latest Nuclear Posture Review, released in February 2018, only mentions strategic stability in general terms and does not explicitly pledge to maintain bilateral strategic stability with China.[116] Moreover, the report's section on China emphasizes the importance of deterring Chinese non-nuclear strategic attacks by means of U.S. nuclear capabilities and maintaining an escalation dominance capability against China "at any level of escalation." Such narratives signal an increasingly confrontational approach, rather than a cooperative nuclear relationship based on a de facto recognition of mutual vulnerability. That said, the Trump administration's National Security Strategy, released in December 2017, does state that "Enhanced missile defense is not intended to undermine strategic stability or disrupt longstanding strategic relationships with Russia or China."[117] The impact of such language on China's thinking about its nuclear relationship with the United States remains to be seen.

Yet U.S. civilian policymakers and military brass do not seem wholly in sync on the issue of whether ASW capabilities should be used against Chinese SSBNs. Whatever approach the United States adopts in its declaratory policy, the U.S. Navy, at an operational level, appears to be interested in developing and exercising a strategic ASW capability against China. If so, there appears to be a disconnect between political and operational U.S. actors, given that U.S. civilian decisionmakers do not seem to have a clear policy on conducting strategic ASW operations against China.

For their own part, some U.S. military officials have voiced alarm about the implications of China's SSBNs. For example, Admiral William Gortney, when he was at the helm of U.S. Northern Command, painted China's SSBNs as a concern in the general sense that they could eventually threaten the U.S. homeland.[118] Captain James Fanell, a former director of intelligence and information operations for the U.S. Pacific Fleet, testified to the U.S. House of Representatives in 2018 that the U.S. Navy must ensure at all times "that every time a [PLA Navy] SSBN departs on a strategic nuclear patrol, the [U.S. Navy] must follow closely enough to be ready to sink them if they ever attempt to launch a nuclear tipped ICBM towards our shores."[119] The underlying thinking of concerned U.S. military officials appears to be that the introduction and improvement of China's sea-based nuclear capabilities could eventually remove any doubt that China has a secure second-strike capability and could, therefore, remove the option for the United States to conduct a first strike against Chinese nuclear forces in a crisis.

Again, the history of U.S.-Soviet (and later U.S.-Russian) nuclear interactions is instructive. In the late 1960s, the Soviet deployment of the Yankee-class SSBN—the first Soviet SSBN with firepower comparable to that of its U.S. SSBN peers—helped change the threat perceptions of the United States.[120] According to one pair of prominent U.S. scholars, this deployment "convinced President Nixon that the United States no longer possessed a viable damage limitation option against Soviet nuclear forces," and it "accelerated a shift in U.S. thinking towards escalation control options in the U.S.-Soviet nuclear competition."[121] Subsequently, the U.S. Navy poured significant resources into strategic ASW against Soviet SSBNs, an approach that (from a U.S. perspective) was rather successful.[122]

In a similar sense, while China's first-generation 092-class SSBN had serious technical problems and never conducted any patrols, the development and deployment of China's second-generation SSBNs may start to represent a more realistic threat to the United States, like the Soviet deployment of the Yankee-class SSBN. As a result, the United States may have incentives to seek to develop an effective strategic ASW capability against Chinese SSBNs in an attempt to avoid the undesirable prospect of mutually assured destruction with China—as Washington did with Moscow during the Cold War.

U.S. allies in the region, too, may view China's growing SSBN capability as a potential threat. In theory, SSBNs could enhance China's nuclear retaliation capability against re-

gional targets, such as U.S. military bases in Japan and South Korea. Although China has categorically renounced the option of using nuclear weapons against non-nuclear-weapon states, Tokyo and Seoul may not be entirely reassured. More importantly, China's growing SSBN capability may increase the concerns of U.S. allies about decoupling—the possibility that more credible nuclear threats to the United States itself might leave Washington less willing to come to allies' defense. These concerns may motivate these U.S. partners to work with Washington to counter China's SSBNs in the region.

Presumably motivated by these threat perceptions, the U.S. Navy openly advertised its efforts to use U.S. SSNs to track, and if necessary, sink Chinese SSBNs.[123] Even before that, there were Chinese reports of joint military exercises held by the United States and its regional allies to practice hunting Chinese SSBNs.[124] Such revelations are unnerving but not surprising, for China has always suspected that Washington is determined to undermine China's sea-based nuclear deterrent. Chinese experts point to collective efforts by the United States and its allies to enhance their ASW capabilities in the Asia Pacific as strong evidence of such intentions.[125] Moreover, some U.S. experts openly call for holding Chinese SSBNs at risk, further raising Chinese concerns. In particular, because of the challenges involved in intercepting Chinese SLBMs after a potential launch, some U.S. experts argue that the safest way to eliminate any future threat from Chinese SLBMs would be to hold Chinese SSBNs at risk so they can be destroyed preemptively before their SLBMs can be launched.[126]

There may be other incentives for Washington to develop strategic ASW capabilities against China. Although it is a minority view that does not appear to have found official favor, some U.S. experts argue that U.S. strategic ASW capabilities could force China to devote a significant fraction of its attack submarine fleet to protecting Chinese SSBNs, thereby reducing the number of Chinese attack submarines available to conduct other missions, such as offensive operations against U.S. surface ships.[127] The United States openly adopted this approach against the Soviet Union toward the end of the Cold War (albeit to unknown effect). Finally, tradition and bureaucratic inertia may contribute to a U.S. interest in developing strategic ASW capabilities against China. After all, U.S. submarine forces have long been trained to track and trail Soviet (and later Russian) SSBNs and have long sought to hold these submarines at risk at all times. In the absence of a decision by the U.S. national leadership not to try to hold Chinese SSBNs at risk, the U.S. Navy might, by default, have applied the same approach to China's emerging SSBN fleet.[128]

THE ADDED DIFFICULTY OF DISTINGUISHABILITY

Even if the United States were willing to refrain from deliberately conducting strategic ASW against China, it would be difficult to completely distinguish strategic ASW operations from tactical ASW operations that are not aimed at Chinese SSBNs. This is an impor-

tant consideration because the United States has a strong interest in developing and deploying ASW forces to counter certain nonstrategic Chinese submarines. Apart from its SSBN fleet, China's nonstrategic SSNs and diesel-electric submarine fleets are growing rapidly in terms of size and capabilities. These submarines may become targets for U.S. ASW capabilities because of the important roles they play in conducting anti-surface warfare, gathering intelligence, escorting surface fleets, and supporting special forces.

The challenge for Washington to demonstrably distinguish between its strategic and tactical ASW operations is somewhat similar to U.S.-Chinese interactions with respect to China's land-based ballistic missiles. The United States, especially under the Obama administration, has implied that it does not seek to intentionally threaten China's long-range nuclear ballistic missiles, but the U.S. government has openly indicated an interest in developing missile defense capabilities to counter shorter-range Chinese regional missiles.[129]

Even if the United States were willing to refrain from deliberately conducting strategic ASW against China, it would be difficult to completely distinguish strategic ASW operations from tactical ASW operations.

For example, Washington has repeatedly sought to reassure China by declaring that U.S. missile defense systems are not designed to threaten China's nuclear ICBMs and do not have the capability to do so.[130] However, Washington has deployed regional missile defense capabilities in the Asia Pacific that are partially aimed at intercepting China's regional missiles.[131] Indeed, in its 2009 Ballistic Missile Defense Review, the United States explicitly stated that "it is important that China understand that the United States will work to ensure protection of our forces, allies, and partners in East Asia against all regional ballistic missile threats."[132] China has not completely accepted the distinction between strategic and regional missile defense systems that the United States is trying to draw, but U.S. efforts may go some way toward clarifying its intentions.

This concern is magnified in the case of Chinese submarines and their maritime environment. Especially given the extreme secrecy surrounding submarine operations, it would be even more difficult to separate strategic and tactical operations underwater than it is on land. Wu Riqiang, for example, is concerned that Chinese SSBNs and SSNs may not be easily distinguishable underwater.[133] In theory, China could base SSBNs at separate ports to help make its SSBNs more easily distinguishable from other submarines. If Beijing were to do so, Washington could more readily delineate between strategic and tactical ASW, and the United States could then—as a confidence-building measure and a gesture of good will—refrain from targeting Chinese SSBN bases in a conflict and from conducting surveillance against them during peacetime.

In practice, however, Chinese SSBNs are invariably commingled with other submarines at ports. The newly built submarine base near Sanya on Hainan Island, for example, is frequently visited by both SSBNs and nonstrategic attack submarines. This practice is quite common. In fact, all British, Indian, Russian, and U.S. naval bases that host SSBNs also serve other functions, including hosting other types of nonstrategic submarines.[134] The French naval base at Brest is the only one in the world that only hosts SSBNs, and France's decision to do so is probably due to geographical constraints.[135] Moreover, in addition to shared ports, it is hard to imagine that China would willingly declare separate operating areas for SSBNs and attack submarines, especially when almost no other countries have opted to do so.

IMPLICATIONS FOR CRISIS STABILITY

The prospect of U.S. ASW capabilities aimed at Chinese SSBNs could threaten crisis stability by posing sobering escalation risks that bear reflecting on, even in light of the perceived past benefits of targeting Soviet submarines during the Cold War. One perceived advantage of U.S. ASW operations against Soviet SSBNs was that, in the early stages of a hypothetical military conflict, Washington could discourage Moscow from further escalating by preemptively destroying Soviet SSBNs and thereby significantly reduce Soviet nuclear forces.[136] It is unknown whether the United States embraces such thinking against China today. If it does, this approach would be very problematic in terms of managing escalation. Washington may hope that a preemptive attack on Chinese SSBNs would discourage escalation, but the risk of an escalatory Chinese response could not be easily ruled out.

The prospect of U.S. ASW capabilities aimed at Chinese SSBNs could threaten crisis stability by posing sobering escalation risks.

Short of attempting to destroy an adversary's SSBNs, U.S. efforts to interfere with an enemy's ability to communicate with its nuclear-armed submarines could create escalation risks of their own. During the Cold War, the United States tried to exploit vulnerabilities in Moscow's nuclear C3 systems, including those associated with the Soviet SSBN fleet. The hope was that, if necessary, the United States could prevent the Soviet high command from issuing launch orders to its SSBNs.[137] Knowing this history, Chinese SSBN commanders could misinterpret an external disruption of their C3 systems as a hostile attempt to disable China's sea-based nuclear deterrent or even as hostile preparations for a disarming strike. There would be a particularly high risk of misinterpretation if China's SSBNs share some C3 infrastructure with the country's attack submarines, as some U.S. experts believe to be the case.[138] If so, an enemy strike against this shared C3 system—even if conducted exclusively to undermine China's conventional military capabilities—could be misinterpreted by

Beijing as an attempt to cut off communications between Chinese leaders and their SSBNs. This scenario would create serious risks of escalation.

Moreover, the growing interactions between China's nuclear assets and other countries' conventional weapons will pose new challenges. Prior to China's first SSBN patrols, all the country's nuclear weapons were deployed exclusively on Chinese territory. With Chinese SSBNs now operating at sea, it is inevitable that the chance of foreign conventional military assets directly confronting Chinese nuclear delivery systems will rise. As early as the mid-2000s, there were Chinese reports of joint naval exercises between the United States and its regional allies to "hunt down strategic nuclear submarines" from "Country C [which is generally believed by Chinese experts to be a thinly veiled reference to China]."[139]

Dangerous encounters involving Chinese SSBNs might grow in number as the United States and its allies enhance their efforts to counter the emerging Chinese SSBN fleet.

Intensified cat-and-mouse games between Chinese SSBNs and enemy ASW platforms have already greatly heightened the risks of an incident during peacetime sparking a conventional military conflict. Potentially dangerous encounters between the Chinese and U.S. militaries are increasing. In many of these cases, China has acted preemptively to remove potential threats to strategic nuclear assets. In recent years, for example, the United States has ramped up its airborne maritime surveillance activities with P-8A aircraft over the South China Sea. Some of these operations focus on tracking or collecting intelligence about Chinese nuclear submarines, a practice that has prompted Beijing to scramble fighter jets on many occasions to intercept U.S. aircraft.[140]

In addition, there have been encounters between U.S. surveillance vessels mapping the sea floor close to China's nuclear submarine base and Chinese naval ships and maritime militia vessels that were dispatched to disrupt such surveillance.[141] Notably, in December 2016, a Chinese naval ship seized a U.S. underwater drone in the South China Sea, despite protests from the nearby U.S. naval surveillance ship that was operating it. The incident increased military and political tensions between the Chinese government and the soon-to-be-inaugurated Trump administration. Some Chinese analysts have since argued that China was attempting to prevent the drone from conducting activities potentially threatening to Chinese SSBNs.[142]

Dangerous encounters involving Chinese SSBNs might grow in number as the United States and its allies enhance their efforts to counter the emerging Chinese SSBN fleet. Because of the involvement of SSBNs, the perceived stakes in such confrontations might be much higher than other confrontations involving purely conventional military forces. In such cases, more rapid escalation is a possible result.

These interactions may impose a new degree of pressure on China's unconditional no-first-use (NFU) policy—a commitment that the country will never or under any conditions use nuclear weapons first. If Chinese SSBNs are threatened by rigorous non-nuclear ASW operations, China's leadership will face the dilemma of deciding whether to continue to uphold an unconditional NFU policy. Beijing is fully aware that this policy would constrain its response options if a Chinese SSBN were to be sunk and would, therefore, likely encourage enemies to vigorously track and trail Chinese SSBNs. So far, China has not indicated that it is reconsidering its NFU policy as a result of introducing an SSBN fleet.[143]

But whether it does so in the future may depend, in part, on how vigorously the United States and its allies pursue ASW in China's coastal waters and how much of a threat China perceives such activities to pose. In fact, if China were to relax its NFU commitment in the future—and indicate that it might consider launching SLBMs during a conventional conflict—adversaries would be further incentivized to pursue more aggressive strategic ASW against Chinese SSBNs, potentially resulting in a negative action-reaction cycle. China needs to find ways to discourage preemptive attacks on its SSBNs other than relaxing the unconditional NFU policy.

Risks of Chinese Conventional-Nuclear Entanglement

A further specific risk of crisis instability comes from China's reported interest in using future SSBNs as platforms for deploying both nuclear and conventional weapons. If Beijing implemented such a deployment strategy, the risk of U.S. tactical ASW operations inadvertently undermining Chinese SSBN forces would increase greatly.

The reasoning behind this suggested commingling is that some Chinese analysts and commentators view SSBNs as holding limited value compared to other military assets. They point out that SSBNs are intended to play only a comparatively narrow role—launching strategic nuclear counterstrikes after China is attacked by nuclear weapons. (After all, under China's NFU policy, all of its nuclear weapons have this same function.) In a military crisis, SSBNs cannot help resolve a regional maritime conflict, escort other ships, or conduct ASW operations. In peacetime, they can rarely contribute to military diplomacy through overseas visits or contribute to counterpiracy, counterterrorism, or refugee/expatriate rescue missions.[144]

In light of the narrow military utility of SSBNs and their high maintenance costs, Chinese analysts have proposed a range of ideas to make the most out of China's SSBN investment. Many of these proposals involve mixing nuclear and conventional weapons on the same submarine. These ideas present a serious challenge to the traditional wisdom of making nuclear deterrence the sole mission for SSBNs—though none of these proposals has become government policy yet.

One example is an argument made by some analysts that China's 094-class SSBNs should be equipped with JL-2 missiles armed with conventional warheads. Although this would be a costly way to use the JL-2 SLBM, these analysts argue that this approach would provide SSBNs with the ability to conduct attack missions against fixed land-based targets. Similarly, some military analysts (including former PLA officers) have proposed on CCTV that submarine-launched variants of the DF-21D and DF-26 anti-ship conventional ballistic missiles should be developed and carried by China's SSBNs. This idea may be technically feasible since the DF-21 was, in fact, originally developed from China's first-generation SLBM. Supporters of this approach argue that it could greatly enhance China's capability to hold U.S. aircraft carriers and other high-value surface ships at risk.[145] In fact, even some U.S. experts have suggested that China may consider arming SSBNs with conventional anti-ship ballistic missiles and/or land-attack cruise missiles.[146]

Mixing nuclear and conventional weapons on the same platform—either by arming SSBNs with conventional offensive weapons or by arming SSNs with nuclear weapons—would blur the line between nuclear and conventional forces.

This interest among some Chinese experts in making the SSBN a multi-mission platform seems to be inspired, in part, by (incorrect) beliefs about U.S. policy. Various Chinese experts wrongly believe that future U.S. Columbia-class SSBNs will be powerful multi-mission platforms,[147] even though there is no evidence that Washington is planning to put offensive conventional weapons on this ship (except for a number of conventional torpedoes for defensive purposes).[148]

Most notably, an article published in *China National Defense News*, a major official PLA newspaper, states that "the U.S. SSBN (X) can be armed with conventional medium-range ballistic missiles, cruise missiles, and can even launch UAVs [unmanned aerial vehicles] and anti-missile interceptors from underwater."[149] (SSBN (X), which will replace the U.S. Ohio-class SSBNs, has since been renamed the Columbia-class.) The article goes on to argue that, with these capabilities,

> strategic ballistic missile submarines will be no longer only a tool of symbolic deterrence but a dual nuclear conventional system for both defensive and offensive purposes, which can be forward deployed with sufficient tactical flexibility, and can be connected with the U.S. space, missile defense and ground combat systems, to become an integrated striking force. This will greatly affect the existing global balance of military power.[150]

The article concludes by arguing that SSBNs armed with various conventional weapons "may become an important concept for major powers to design and construct large strategic nuclear submarines in the future."[151]

Song Zhongping, a retired PLA officer and prominent military commentator on official Chinese media outlets, made an even more radical statement by claiming that countries' SSNs and SSBNs in the future will become integrated, implying that the differences between them will gradually disappear.[152] Following this line of thinking, some Chinese analysts have proposed that Beijing should consider arming its 093-class SSN with the CJ-10 nuclear-armed cruise missile (in addition to conventional weapons) to further diversify China's nuclear second-strike platforms.[153] Again, this idea does not necessarily represent Chinese government policy or thinking, but if it or similar concepts are implemented in the future, the implications could be very negative.

Mixing nuclear and conventional weapons on the same platform—either by arming SSBNs with conventional offensive weapons or by arming SSNs with nuclear weapons—would blur the line between nuclear and conventional forces. If this were to happen, a U.S. attack aimed at neutralizing Chinese conventional weapons might unintentionally compromise Chinese nuclear capabilities. In such a case, China could conclude, incorrectly, that the United States was seeking to destroy its nuclear deterrent, a situation that would result in dangerous and unnecessary escalation risks.

IMPLICATIONS FOR ARMS RACE STABILITY

Beyond the aforementioned complications involving escalation risks in a crisis, U.S. efforts to target Chinese SSBNs with its ASW capabilities would also have a direct bearing on Chinese and U.S. naval procurement decisions in the coming years.

After all, if the United States seeks to wield a strategic ASW capability against China, it is uncertain that it would succeed. However, China cannot be sure that its SSBNs will be safe in the future, particularly if they become targets for enemy ASW capabilities. If both countries continue on this course, this dual uncertainty may encourage each side to invest even more heavily in this competition to try to shift the balance in its own favor. So far, Washington has not started to increase its SSN forces, but there are growing domestic calls to do so. Moreover, the United States has already taken measures to increase its production capacity so that, if needed, it can roll out new SSNs more quickly.[154] If not well managed, these dynamics could evolve into a direct arms competition.

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The insufficient quietness and limited survivability of China's existing SSBNs could further motivate the U.S. Navy to pursue strategic ASW efforts, believing that such operations would be relatively easy. Such U.S. attempts could, in turn, induce China to build a bigger

SSBN fleet (with longer-range missiles) to increase the fleet's overall survivability, even before China masters the technology to build much quieter SSBNs. Such an arms race would surely be very costly and destabilizing.

Assuming that SSNs are the United States' most important ASW asset for countering Chinese SSBNs (as is generally believed), it is worthwhile for both U.S. and Chinese strategists to examine whether Washington theoretically would have enough military resources to develop a viable strategic ASW capability against China. Existing U.S. assessments indicate that Beijing currently possesses four operational 094-class SSBNs and may build a total of five to eight such boats. When China starts to construct the 096-class SSBNs in the early 2020s, that number could further grow.[155]

With a total of five 094-class SSBNs, China may be able to keep one or two of them at sea at all times.[156] If Beijing has eight SSBNs, it may be able to keep two to four of them at sea. The exact number would depend on a series of factors, including whether China can prepare two sets of crews for each SSBN, whether Beijing has an effective logistical support system to maximize the time that its SSBNs can spend at sea, and the lifetime of Chinese reactor cores. In any case, these estimates are consistent with a general consensus among Chinese and foreign experts that Beijing is likely to maintain a total of fewer than ten SSBNs and to want to keep somewhere between one and three of them on constant patrol. (Having more than one SSBN on patrol would hedge against the risk of one of them falling prey to enemy ASW operations.)[157]

Given this baseline, it is possible to estimate how many SSNs the United States would need to track patrolling Chinese SSBNs. Based on Cold War experience, some U.S. experts assume that the United States would need to possess five SSNs to keep track of each Chinese SSBN at sea.[158] This estimate takes into consideration all the time that SSNs need for transit, training, and maintenance. This figure seems to be generally consistent with the historical record of the 1980s, when the Soviet Union kept about six to twelve SSBNs at sea and the United States was more or less able to shadow them with a total inventory of about 100 SSNs, a considerable number of which were probably forward deployed and charged with the mission of tracking Soviet SSBNs during peacetime.[159]

The assumption that five U.S. SSNs are needed to track each enemy SSBN only applies, however, to situations in which U.S. SSNs are able to quickly pick up their targets as or shortly after the SSBNs leave port. During the Cold War, if a Soviet SSBN was able to reach its patrol area and then disappear before U.S. SSNs could start tracking it, U.S. forces had a much harder time finding it again. The scale of this challenge depended on a range of variables, including the specific patrol tactics used by Soviet SSBNs. When Soviet nuclear-armed submarines started to adopt more advanced technologies and became quieter toward the late 1980s, it became even more difficult for the United States to keep track of them. Owen R. Cote, a highly regarded U.S. expert on ASW, goes as far as to say that "[there

were] several incidents in which the entire [U.S.] Navy had to deploy in order to find and maintain contact on one [Soviet] submarine."[160]

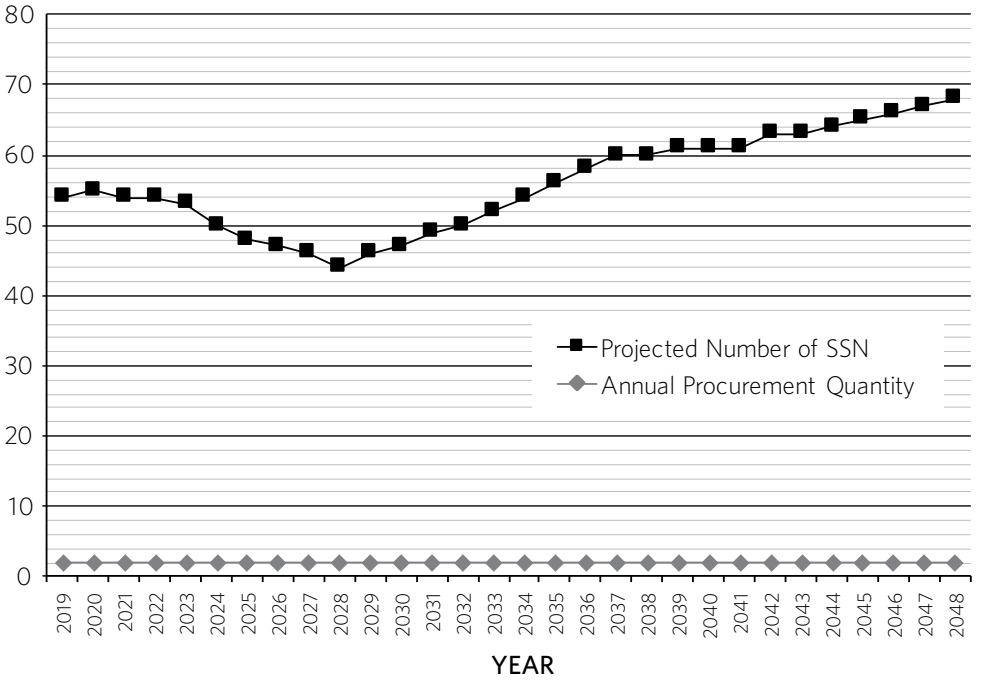
In the U.S.-China case, if Beijing keeps between one and three SSBNs at sea, Washington would need to devote five to fifteen SSNs to tracking and trailing them, assuming that SSNs are the primary U.S. ASW platform deployed against Chinese SSBNs. If Washington supplements its SSNs with other ASW platforms, the required number of SSNs could go down. That said, contrary to the Cold War, when the primary mission of U.S. SSNs was to conduct strategic ASW against Soviet SSBNs, existing U.S. SSNs are probably primarily assigned to missions other than tracking SSBNs, let alone just Chinese ones. Today U.S. SSNs are involved in conducting anti–surface ship operations, protecting U.S. surface ships, intelligence collection, offensive and defensive mine warfare, and supporting special operation forces, among others.[161]

Between 2006 and 2016, the U.S. Navy maintained a constant goal of possessing forty-eight SSNs; then, in 2016, the goal was raised to sixty-six submarines.[162] With forty-eight SSNs, it would be challenging for the United States to devote enough of them, on a full-time basis, to the strategic ASW mission against China. This would be especially true if the required number of submarines for the mission were near the upper range of fifteen SSNs. How much this calculus will change when the new goal of sixty-six SSNs is achieved is unknown.

Although the relevant U.S. literature often cites China's growing naval power as the main reason for raising the United States' SSN goal, it is difficult to know if, or to what extent, this new requirement was motivated by efforts to counter future Chinese SSBNs or other naval capabilities.[163] That said, U.S. analysts have indicated that, during a crisis involving China, the United States could increase the number of SSNs tasked with tracking down Chinese SSBNs (at the expense of other missions).[164] This surge capability could help the United States avoid having to dedicate a certain number of SSNs to strategic ASW missions against China at all times, further reducing the numerical requirement for U.S. SSNs. Such a surge strategy may involve some drawbacks, because not having the SSN crews practice tracking Chinese SSBNs during peacetime may undermine their ability to do so in a crisis. But these considerations may be secondary for U.S. naval planners.

Another complication for Washington is that, given the projected force level of the U.S. SSN fleet over the next few decades (shown in figure 2), the United States will be hard-pressed to maintain a force of forty-eight SSNs for a window between 2025 and 2031 or a force of sixty-six SSNs between now and 2047. If Washington is to conduct systematic strategic ASW against Chinese SSBNs, including in peacetime, it may need to introduce even more SSNs (beyond those currently planned) in the near to medium term. It may be difficult to do so, as the U.S. submarine production industry will already be stretched to build two Virginia-class SSNs per year over the next three decades when it also needs to divert resources into building the new Columbia-class SSBNs.[165]

FIGURE 2. THE PROJECTED SIZE OF THE U.S. SSN FLEET (2019–2048)



Source: Ronald O'Rourke, "Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress," Congressional Research Service, July 31, 2018.

Given these competing dynamics, there is a dual uncertainty shared by Beijing and Washington about whether Chinese SSBNs could be shielded from U.S. ASW capabilities and whether the United States would have enough SSNs to make a credible attempt to track Chinese SSBNs (if it chose to try). This uncertainty could create incentives for both countries to increase their production capacities more than they otherwise would—an outcome that would have deleterious consequences for arms race stability.

THE IMPACT OF CHINESE SUPPORTING CAPABILITIES

IN THE NEAR to mid-term, absent a surprise development of disruptive military technologies or new geostrategic realities around the South China Sea, Beijing's SSBN operations are likely to heavily rely on the bastion strategy. Such an approach would be reliant on Chinese supporting efforts to help keep the country's SSBNs safe from opposing ASW capabilities.

BASTION STRATEGY AND SEA CONTROL

For China, establishing an SSBN bastion in the fiercely contested waters of the South China Sea would require a requisite degree of sea control; apart from improvements to and growth in the country's SSBN fleet, achieving this task will impose high demands on the PLA's supporting capabilities. Moreover, the deployment and employment of such supporting capabilities could create additional escalation risks.

For China, establishing an SSBN bastion in the fiercely contested waters of the South China Sea . . . will impose high demands on the PLA's supporting capabilities.

The history of U.S. and Soviet naval encounters during the Cold War offers reason for caution. In the 1980s, after the Soviet Union withdrew its SSBNs to bastions in coastal areas, the U.S. Navy followed them in an effort to keep holding the submarines at risk. In response, Moscow took pains to strengthen the bastions and protect its SSBNs. Dangerous confrontations between Soviet and U.S. forces took place continually during this period.[166]

Because of China's less favorable maritime environment, Beijing will face even greater challenges today establishing an SSBN bastion than Moscow did during the Cold War. The Soviet Union had the luxury of building SSBN bastions in relatively isolated coastal waters. The Kara Sea and the Sea of Okhotsk are far enough from any other countries that functionally they could almost be considered Soviet waters.

By comparison, the South China Sea is anything but isolated. It contains the world's most important trade routes, carries about one-third of global shipping volumes, and provides passage to about half of the world's merchant ships.[167] Moreover, the South China Sea is surrounded by several countries, many of which claim sovereignty over overlapping parts of it and exercise actual control over different land features. Clashes over fishing rights, oil resources, and sovereignty break out frequently. From a military perspective, the presence of naval vessels from multiple surrounding countries makes the South China Sea potentially crowded. States from outside the immediate region—particularly Japan, South Korea, and the United States—also have important interests there, including the protection of trade routes. These countries, therefore, operate their navies in the vicinity from time to time as well.

So far, instead of pursuing a measure of sea control, Beijing has prioritized efforts to improve its sea-denial capability—that is, the ability to make some of its coastal waters unsafe for enemy ships to operate in. China has developed so-called A2/AD weapons for this purpose. For example, Beijing designed the DF-21D and DF-26 ballistic missiles to strike large surface ships and so deter such ships from operating close to the Chinese coast. Such capabilities can help prevent external powers from militarily infringing on China's core national security interests, including in any future conflict over Taiwan. But establishing an SSBN bastion is much more demanding than simply making a body of water unsafe for an enemy's ships; this task would require China to make a body of water safe only for its own submarines and ships. Foreign ASW-capable platforms—including surface ships, submarines, and aircraft—would need to be repelled from the area when necessary.

China will not find it easy to obtain such sea control. The United States would be highly unlikely to willingly cede to China the power to control parts of the South China Sea. On the contrary, given the increasing tensions resulting from maritime territorial disputes in the region, Washington has started to dispatch regular flotillas to the South China Sea to conduct freedom of navigation operations (FONOPs) to assert what the United States sees as its rights. Upholding the principle of freedom of navigation is now a U.S. priority in the South China Sea. In June 2016 alone, for example, two U.S. carrier strike groups transited the South China Sea to conduct FONOP-related operations.[168] An added motivation for the United States and other regional countries to prevent any single state from unilaterally controlling part of the sea and denying access to others is the July 2016 verdict of the Permanent Court of Arbitration in The Hague that challenged the legitimacy of China's nine-dash-line-based territorial claims in the South China Sea. Since taking office, the

Trump administration has continued to conduct FONOPs, following a short break, and senior U.S. officials have reaffirmed their determination to continue and further enhance such activities.[169]

In addition to its commitment to freedom of navigation, the United States is quickly enhancing its ASW capabilities in the region. Washington sees the gradual improvement of China's submarine forces—including its SSBNs, SSNs, and advanced diesel-electric submarines—as a major security threat. Despite the technical inferiority of individual Chinese submarines compared to U.S. ones, the United States is concerned that China's overall submarine fleet is apparently already larger than its own and that this gap may continue to grow.[170]

Notably, the United States already deploys 60 percent of its entire submarine fleet to the Pacific, and the U.S. military continues to deploy more maritime assets from other theaters to the Asia Pacific region.[171] For instance, the former commander of U.S. Pacific Command, retired Admiral Harry Harris Jr., testified to Congress in 2016 that more SSNs are needed in the region to counter Chinese naval forces.[172] Since the days of the Obama administration, Washington has increased the tempo of operations in the South China Sea involving advanced surface ships, many of which are equipped with cutting-edge ASW capabilities.

With U.S. allies opening their military bases and airspace, the United States has deployed its most advanced anti-submarine aircraft around the South China Sea. To supplement older P3-C Orion aircraft, which have long operated in the region (including for ASW purposes), Washington has deployed much newer P8-A Poseidon aircraft to Okinawa, Japan; the Philippines; and Singapore. Malaysia has reportedly agreed to host such aircraft in the future.[173] Additional states, including Australia, have purchased P8-A aircraft with the expectation that they can play a role in countering China's growing submarine threat. Looking ahead, the competition is only getting more intense.

IMPLICATIONS FOR CRISIS STABILITY

Some overseas analysts have interpreted steps that the Chinese military appears to be taking to track other countries' naval vessels operating in the South China Sea to have exacerbated escalation risks. Following the reported establishment of the Maritime Navigation Identification Zone in the South China Sea,[174] the deputy chief of staff of the PLA Navy, Rear Admiral Wang Weiming, claimed in 2017 that the Chinese military "will track every military vessel and will intercept every aircraft within the scope of their responsibilities."[175] This declaration has raised concerns in other countries that, if implemented, such a policy could increase the risks of a peacetime incident leading to a conventional military conflict.[176]

Any steps China takes to purge from some part of the South China Sea all non-Chinese ASW platforms would encounter significant challenges. In particular, serious military confrontations could break out, as earlier Chinese efforts to interfere with foreign ASW-related

operations in the South China Sea demonstrate. In the past few years, China has frequently scrambled fighter jets to intercept U.S. maritime aircraft, such as P8-As, over areas not far from the Hainan submarine base. In some of these cases, Chinese pilots have made aerobatic maneuvers very close to U.S. aircraft to stop them from conducting surveillance, which Beijing believes was sometimes directed against SSBNs hiding underwater. Some of these interceptions were so dangerous that the United States repeatedly protested them, further straining the U.S.-China military relationship.[177] As China starts to deploy its SSBNs from Hainan, dangerous encounters may become more frequent. In a future hypothetical crisis, if China follows the U.S. doctrine of attempting to preemptively destroy enemy airfields to prevent anti-submarine aircraft from taking off in the first place, even more serious risks of rapid escalation could result.[178]

Any steps China takes to purge from some part of the South China Sea all non-Chinese ASW platforms would encounter significant challenges.

Aside from its surveillance aircraft, the United States sometimes dispatches surface ships to the South China Sea to map the seafloor and collect hydrographic measurements. These activities, especially if conducted near Chinese SSBN bases, can spark incidents. In May 2009, for example, Chinese maritime militia ships harassed the U.S. Navy's *Impeccable* by trying to prevent it from conducting surveillance and attempting to snag its acoustic equipment in the water. In response, the *Impeccable*'s crew shot their water cannon at the Chinese vessels.[179]

Potential escalation risks could extend to land as well. In the future, China may follow the Russian practice of deploying more and higher-quality land-based anti-ship cruise missiles, as well as its unique anti-ship ballistic missiles, along the coast to protect Chinese SSBNs by repelling enemy ASW-capable surface ships.[180] According to the U.S. Joint Concept for Access and Maneuver in the Global Commons (JAM-GC), a U.S. military concept that succeeded Air-Sea Battle, Chinese anti-ship missiles are a key component of China's A2/AD capability and might be preemptively attacked in a regional conflict to protect all large U.S. surface combatants. Yet, regardless of U.S. intent, China might interpret the loss of its anti-ship missiles at the beginning of a hypothetical conventional conflict as linked to a U.S. effort to undermine the survivability of its SSBNs.

Furthermore, the underwater measures China might take to reduce the threat posed by enemy SSNs could be seen by others as provocative and potentially increase the risk of incidents. In February 2017, the Legislative Affairs Office of the State Council started to seek public comments on a revised draft of the Maritime Traffic Safety Law of the People's Republic of China. This revised draft stipulates that, when in Chinese territorial waters, foreign submarines need to stay surfaced, show their national flag, and report to China's

maritime administrative agencies.[181] There is concern that this new law, if passed, might have implications for foreign submarine activity in major parts of the South China Sea—especially given that China has not clarified over which parts of the South China Sea it claims sovereign rights.[182] A further concern is that Chinese efforts to enforce any new rules by, for example, attempting to repel foreign ASW platforms, could precipitate confrontations.

There is undoubtedly a need to address the immediate, increasing risks of confrontations between Chinese forces tasked with defending SSBNs and foreign ASW forces—a task that maritime safety rules are designed to undertake. Yet the existing rules have shortcomings, particularly given the fact that their implementation is voluntary. For instance, the Code for Unplanned Encounters at Sea, which more than twenty countries (including China and the United States) have adopted, is ultimately a set of nonbinding abstract rules that do not identify "specific applicable waters."[183]

There is undoubtedly a need to address the immediate, increasing risks of confrontations between Chinese forces tasked with defending SSBNs and foreign ASW forces.

Moreover, sometimes it is unclear which rules even apply. Although both China and the United States have agreed to implement it, the Convention on the International Regulations for Preventing Collisions at Sea is mostly aimed at regulating behavior on the high seas. In the South China Sea, the boundaries between territorial waters, exclusive economic zones (EEZs), and international waters are heavily disputed, making it unclear which rules apply. While the resolution of territorial disputes in the South China Sea would certainly simplify the implementation of risk reduction measures, such resolution will take time given the complex issues and the many stakeholders involved.

To complicate matters yet further, many regional actors have different interpretations about what activities are permissible under the freedom of navigation on the high seas and within an EEZ, or under the right of innocent passage within territorial waters. The United Nations Convention on the Law of the Seas (UNCLOS) does not meaningfully regulate military activities on the high seas or in EEZs. (Its relevant provisions, for example, vaguely reserve the high seas for "peaceful purposes.")[184]

Moreover, UNCLOS contains no specific rules about which military activities are permitted within an EEZ—a point of considerable disagreement. A number of states, including China, claim that activities undertaken by military vessels in an EEZ that are nonpeaceful or undermine the coastal country's security (including military surveillance and reconnaissance activities) are not permissible under UNCLOS. By contrast, other states, including the United States (which has not signed UNCLOS), claim that such activities are permitted under the auspices of freedom of navigation. Similarly, China (among some other

countries) insists that prior notification and permission is required before a foreign military vessel can navigate through its territorial waters, while the United States dismisses such claims.[185] These disagreements could be an added source of military tension when China begins to aggressively implement the bastion strategy in the South China Sea.

IMPLICATIONS FOR ARMS RACE STABILITY

Facing a growing ASW threat from the United States and its allies, Beijing seems fully determined to protect its SSBNs and expend the necessary resources to do so. Indeed, China has significantly expanded its general-purpose military capabilities that are useful for protecting its SSBNs, otherwise known as pro-SSBN operations. In this respect, the nuclear competition between China and the United States is already starting to spill over into the conventional military domain. If Washington and its allies continue to enhance their capabilities to threaten Chinese SSBNs, Beijing is very likely to build up its supporting capabilities further. This, in turn, could spark U.S. countermeasures. The result could be a conventional arms race with implications for neighboring countries and regional security.

If Washington and its allies continue to enhance their capabilities to threaten Chinese SSBNs, Beijing is very likely to build up its supporting capabilities further.

Given the widespread belief among Chinese analysts that enemy attack submarines pose the gravest threat to China's SSBNs, there have long been calls for Beijing to counter by greatly enhancing its own ASW capabilities.[186] Indeed, China has begun comprehensively stepping up its investment in ASW development and deployment. At the most fundamental level, Beijing has made maritime surveillance, and especially hydroacoustic surveillance, an important part of the 863 National High Technology Research and Development Program—a major initiative to strengthen China's independent capacity in key advanced technologies. Indeed, in recent years, Beijing has capitalized on this research and made massive investments toward building a multidimensional network of surveillance systems—consisting of underwater sensors, satellites, airborne platforms, and land-based integration systems—to quickly detect and identify enemy submarines and other military vessels.[187]

China's progress has been significant. In early 2010, for example, the Shore-Based Fiber-Optic Array Underwater Acoustic Integrated Detection System—a key project under the 863 Program to develop China's underwater hydrophone network—was successfully completed.[188] In May 2017, CCTV and the Xinhua News Agency revealed a new plan to invest more than 2 billion renminbi (about $300 million) over the next five years to complete a national underwater surveillance network in the South and East China Seas.[189] Once completed, this surveillance network could greatly enhance China's underwater situational awareness—a key capability for protecting its SSBNs.

Beijing has made progress with respect to its ASW air force and naval assets as well. China's new-generation anti-submarine aircraft, the High-Tech VI (Gaoxin-6), made its debut in 2013, representing a major step forward.[190] Over the past decade, China has prioritized efforts to enhance the ASW capabilities of its warships as well. The country's new 052D missile destroyer and the 054A frigate, for example, are equipped with advanced ASW sensors and weapons. In addition, according to some reports, China is building advanced new naval surveillance ships for ASW purposes.[191]

Despite these signs of progress, China may be required to invest much more than it already has to protect its SSBNs in a coastal bastion—if U.S.-Soviet Cold War history is any indication. Starting in the mid-1970s, when Moscow adopted the bastion strategy, it had to readjust its overall naval strategy and devote a significant fraction of all its naval assets to pro-SSBN operations. The Soviet Navy pursued a strategy of sea control "on behalf of missile submarines not [as] a secondary but, along with strategic strike, a main goal, to be carried out using surface ships, aviation, and general-purpose submarines as the first and main task from the very beginning of the war."[192] During that period, Soviet exercises "focused on finding and destroying enemy submarines and protecting their own missile subs."[193] A 1979 U.S. Department of Defense–sponsored study on Soviet naval strategy concluded that "the SSBN-protection mission would be either number one in importance or among the top three" in the Soviet naval mission structures.[194] Other Pentagon reports have highlighted the disproportionate degree to which general-purpose Soviet forces were occupied with pro-SSBN operations.[195]

Soviet aircraft carriers helped protect the country's SSBNs as well. In fact, for some of its helicopter carriers, that was their primary mission.[196] Efforts to defend SSBNs place stringent demands on sea-control capabilities and supporting general-purpose military assets, a fact that seems to have left a deep impression on some Russian experts, who have recently argued that Beijing's interest in building aircraft carriers may be partly aimed at protecting its SSBNs in the South China Sea.[197]

Independent Chinese analysts even argue that, to provide effective cover for its SSBNs, China needs many more than two or three aircraft carriers.[198] To be sure, the comments of independent analysts do not necessarily represent official Chinese policy or thinking, but they do reflect a general belief in China's analytical community that the power projection capability of aircraft carriers could be useful for enhancing Beijing's sea-control capabilities. That said, in coastal regions like the South China Sea, aircraft carriers may not be irreplaceable; in the absence of carriers, SSBNs could get air support from aircraft based on the mainland or nearby newly built islands. Aircraft carriers may, in fact, be more useful for protecting SSBNs operating in the open ocean.

Geographic distance may play a complicating role in the South China Sea, although recent Chinese reclamation efforts may be mitigating this challenge. Historically, China has

not had a permanent military foothold in the central and southern parts of the sea, which are located more than 1,000 kilometers away from Hainan Island. That being the case, Chinese analysts have pointed out that Beijing's massive land reclamation efforts, including in the Spratly Islands, could offer critical support for Chinese efforts to protect its SSBNs. Specifically, these features could serve as resupply and maintenance bases for the Chinese ships assigned to defend SSBNs, host radars and other sensors for detecting and identifying enemy ships and aircraft, provide landing facilities and logistical support to Chinese anti-submarine aircraft and fighter jets (which could be used to help repel enemy ASW assets), and serve as a land base for underwater hydrophone networks.[199]

There is evidence that China is already using these islands in at least some of these ways. For example, the newly built hangers beside the runway on Subi Reef in the Spratly Islands are large enough to accommodate China's most advanced anti-submarine aircraft, the Gaoxin-6.[200] Chinese analysts point out that if these aircraft use the runways and facilities on Woody Island and Subi Reef to conduct ASW patrols over the vast area of the South China Sea between these features, operational efficiency would improve by a factor of four over operations that use Woody Island alone.[201] In the future, China is likely to make greater use of these islands.

Further efforts to protect China's SSBNs are likely to follow. Ross Babbage from the Center for Strategic and Budgetary Assessments worries that Chinese infrastructure in the South China Sea may be used to support an underwater acoustic surveillance network to counter U.S. and allies' submarine activities.[202] Moreover, in August 2016, *Kanwa Asian Defense*, a Canadian magazine, claimed that, according to credible Chinese sources, Beijing will indeed establish a Maritime Navigation Identification Zone and an Underwater Acoustic Identification Zone in the South China Sea in the future. According to this report, China will deploy advanced radars and other sensors on its man-made islands to detect and track foreign ships operating within the Maritime Navigation Identification Zone; the report also suggests that Beijing will deploy various underwater hydrophone systems around the islands and in the Underwater Acoustic Identification Zone to detect and track foreign submarines.[203] This report has not been confirmed by official sources, but there is very credible evidence that China is building ambitious underwater sensor networks in the South China Sea and other coastal regions.[204]

Despite the potential strategic benefits of using these islands, the costs of land reclamation and associated infrastructure projects are astronomical.[205] If these projects have indeed been motivated, at least in part, by the task of protecting Chinese SSBNs, that would demonstrate how even a seemingly limited SSBN program can have far-reaching military and financial implications. Moreover, these projects have increased the overall threat perceptions of neighboring countries, prompting them to take aggressive countermeasures.

Even if China can create and maintain a safe SSBN bastion in the South China Sea, the limited range of the JL-2 SLBM would, for the foreseeable future, force Beijing to send its 094-class SSBNs out into the Western Pacific during a serious crisis. In such a situation, significant support from general-purpose forces would be needed to escort Chinese SSBNs through the chokepoints in the First Island Chain. The threats these submarines might face would come not only from the ASW capabilities that the United States and its allies deploy routinely along these waterways in peacetime but also from additional resources that could be mustered during a crisis.

Some Chinese analysts have speculated that to ensure the safe transit of its SSBNs, China would need to make two surface battleship flotillas available for quick deployment at the first sign of an emerging crisis—one near the Okinawa Trough and a second in the Western Pacific. The assumption is that at least four military vessels—including destroyers and frigates—would be required for each flotilla. Assuming that only one-third of such ships could be on active patrol at any given time, China would need at least twenty-four destroyers and frigates primarily devoted to the mission of protecting its SSBNs' passage to the Western Pacific.[206]

According to a 2018 U.S. Department of Defense report, China has a total of twenty-eight destroyers and fifty-one frigates (including older vessels).[207] Using twenty-four destroyers and frigates for SSBN escort operations across the First Island Chain alone would, therefore, consume about one-third of the Chinese navy's main battleships. This would represent another major investment in the country's supporting capabilities for its SSBNs. Moreover, that projection does not take into consideration all the additional conventional forces that may be needed to protect the pro-SSBN supporting forces themselves from enemy threats, a reality that would pose another major logistical challenge.

For PLA strategists, the resources required to protect Chinese SSBNs may appear to be proportionate to the importance of the mission, especially when compared to the Soviet investment of general-purpose naval forces for the same purpose. However, the nuclear competition between the two superpowers during the Cold War was much more intense than the current U.S.-Chinese competition. For Beijing to make such a large investment of resources to protect a nuclear force that Washington is not determined to eliminate runs the risk of making nuclear weapons a disproportionately important issue between the two countries and unnecessarily exacerbating threat perceptions on both sides.

THE IMPACT OF FUTURE UNMANNED SYSTEMS

NEW TECHNOLOGIES, especially autonomous and unmanned systems, could further fuel the emerging nuclear dimension of the naval competition between China and the United States. In particular, U.S. efforts to intensify its development and use of unmanned systems could greatly expand U.S. ASW capabilities in destabilizing ways that China would view as threatening to the survivability of its SSBNs. To avoid being disadvantaged, China would likely be prompted to counter by building more unmanned systems of its own and adopting more destabilizing military countermeasures.

New technologies, especially autonomous and unmanned systems, could further fuel the emerging nuclear dimension of the naval competition between China and the United States.

CHINESE CONCERNS

If unmanned systems turn out to be capable of substantially upsetting the offense-defense balance in underwater warfare, they could provoke an unforeseen radical change to the future survivability of Beijing's sea-based nuclear deterrent. In recent years, China has captured foreign unmanned underwater vehicles (UUVs) close to Hainan Island in the South China Sea. The country's national security agencies suspect that these UUVs are monitoring Chinese military vessels and collecting other forms of close-in intelligence, such as mapping the seabed and gathering hydrographic information.[208] Chinese analysts are particularly concerned that UUVs and unmanned surface vehicles (USVs) are being used to spy on Chinese SSBNs operating in the area, survey their operational environment, and

even directly threaten them with offensive weapons.[209] This analysis focuses more on the impact of UUVs, which is generally considered representative of the impact of other types of unmanned maritime systems including USVs.

The United States tops the list of Chinese concerns about the development and deployment of unmanned systems. Since 1994, the U.S. Navy has published four Navy Unmanned Undersea Vehicle (UUV) Master Plans.[210] Since the publication of the second master plan in 2000, the U.S. Navy has increasingly focused on using UUVs for ASW missions. This trend is reflected in other U.S. defense planning documents, including the Department of Defense's Unmanned Systems Roadmaps, which were later renamed Unmanned Systems Integrated Roadmaps.[211]

Unmanned systems could provoke an unforeseen radical change to the future survivability of Beijing's sea-based nuclear deterrent.

One application UUVs are used for is conducting intelligence preparation of battlespace operations, including collecting data about seafloor topography, underwater currents, and other hydrological information.[212] One advantage UUVs have for conducting this mission is that their small physical size allows them to operate in shallow waters. Although current U.S. underwater hydrophone systems cover the main chokepoints along the island chains on the edge of the Western Pacific, they do not cover all waterways and maritime areas of interest; other U.S. ASW surveillance systems, including satellite-based ones, may be stretched to provide constant and effective surveillance.[213] UUVs and USVs can help fill this gap. Their ability to conduct patrols automatically for prolonged periods is another advantage. For example, the Defense Advanced Research Projects Agency's (DARPA) ASW Continuous Trail Unmanned Vessel (ACTUV) Program has produced a vessel—known as Sea Hunter—that has a reported range of 10,000 nautical miles at a speed of 12 knots; the vessel already has completed its initial sea trials and has been transferred to the U.S. Navy.[214]

Beyond general intelligence and surveillance purposes, U.S. UUVs could be used in more aggressive ways. The 2004 Navy UUV Master Plan, the most recent one made public, raised concerns in China because it explicitly identified "hold at risk" as one important ASW mission for UUVs. (A more recent plan was reportedly completed in 2011 but remains classified.)[215] The hold-at-risk mission would include "monitoring all the submarines that exit a port or transit a chokepoint," presumably for the purpose of ensuring that such submarines can be trailed and, if necessary, destroyed.[216] A 2009 RAND Corporation study sponsored by the U.S. Navy explored the practicalities of this mission by considering the use of one or more UUVs to patrol secretly near an enemy's submarine base to detect and trail exiting submarines in a timely fashion. As a hypothetical example, this study uses China's submarine base at Jianggezhuang, an important facility on the Yellow Sea where Chinese SSBNs have often been spotted by satellites. The study concludes that an effective barrier could be "established outside a port, such as the Jianggezhuang submarine base,

using a UUV operating at 0.5 [knots] and able to detect and classify at a range of 0.125 [nautical miles]."[217]

The growing U.S. interest in using UUVs for ASW coincides with the ongoing challenges that the United States faces in using manned systems for this purpose. With a tightened military budget and stretched shipbuilding capacity, the U.S. Navy cannot afford to dramatically increase its total number of manned platforms. As figure 2 shows, the size of the U.S. SSN force is projected to continue to decline until around the late 2020s, as old models are decommissioned.

Moreover, and more importantly, UUVs may possess certain operational advantages over manned systems for ASW. For example, compared with smaller diesel-electric submarines (which the U.S. Navy does not possess), the United States' large nuclear-powered attack submarines face challenges operating in "shallower waters" close to an enemy's coast. If enemy submarines "submerge near their homeports," they can capitalize on this weakness and stay "outside the reach of U.S. Forces," according to the U.S. Navy's 2004 UUVs master plan.[218] Chinese analysts view Washington's decision to focus, in recent years, on augmenting ASW capabilities for shallow and coastal waters as evidence of an intention to counter Chinese submarines.[219]

UUVs may possess certain operational advantages over manned systems for ASW.

According to U.S. analysts, an additional advantage of unmanned systems is that using them to "perform relatively routine tasks (such as tracking threatening submarines) could free remaining U.S. SSNs" for other missions.[220] Moreover, given China's growing A2/AD capabilities, unmanned systems are considered to be "better able to detect stealthy submarines" without exposing their mother surface ships to the danger of sailing within range of Chinese anti-ship missiles.[221]

So far, the United States has been relatively restrained in its use of unmanned systems for ASW missions. A RAND report observes that, to date, the main U.S. objective in using UUVs for ASW has been "to conduct ASW operations short of weapons engagement."[222] That said, the report does note that a "further objective is to perform this function [of weapons engagement]." For their part, Chinese analysts expect that the United States will deploy the most advanced unmanned ASW first to the Asia Pacific and that China will be the primary target. They expect Washington to deploy an ASW-capable USV as early as 2018. Unmanned ASW platforms are expected to be deployed first along the First Island Chain and at U.S. bases in Singapore; Okinawa, Japan; the Philippines; and Australia to monitor Chinese submarines operating in the East and South China Seas as they transit through the region's limited number of chokepoints.[223]

IMPLICATIONS FOR CRISIS STABILITY

The deployment of unmanned systems could enable states to engage in more aggressive behavior in a crisis. Without the need to worry about human casualties, military commanders might be emboldened to use unmanned vehicles more assertively than they would use manned systems. For example, because self-exposure is less of a concern for UUVs than it is for manned systems, UUVs use active sonar more frequently to detect enemy vessels.[224]

If the United States were to use UUVs to help hold Chinese SSBNs at risk—or even if Beijing believed U.S. UUVs were being used in this way—there would be a chance that the Chinese surface ships and aircraft tasked with protecting SSBNs might misunderstand the intentions behind specific maneuvers conducted by U.S. unmanned systems. An unmanned mission for collecting intelligence against nearby Chinese SSBNs could be misinterpreted as cueing subsequent ASW strikes. In addition, there would be a chance that Chinese forces might mistakenly assume that foreign UUVs and USVs tasked with general surveillance are specifically targeting Chinese SSBNs.

The deployment of unmanned systems could enable states to engage in more aggressive behavior in a crisis.

According to the previously mentioned 2009 RAND report, Washington's potential use of UUVs to hold Chinese SSBNs at risk in theory would take place "under existing rules of engagement and without inadvertently escalating a conflict."[225] However, there has not been an in-depth discussion about how this mission could be performed by unmanned systems—which would need to be armed—in a manner that would effectively avoid the risk of inadvertent escalation.[226]

One way to help mitigate the risk of inadvertent escalation resulting from unplanned encounters at sea is to establish effective communication mechanisms to help each party quickly determine the other's intent in such situations. To this end, rules for managing unplanned encounters in the Asia Pacific region between military vessels and aircraft have been established in recent years. In 2014, twenty-one Pacific countries adopted the Code for Unplanned Encounters at Sea (CUES) at the Western Pacific Naval Symposium in Qingdao. Similarly, China and the Association of Southeast Asian Nations (ASEAN) agreed, at the nineteenth ASEAN-China Summit in 2016, to apply the CUES rules in the South China Sea. In addition, in 2014, the United States and China signed a bilateral memorandum of understanding on safety rules concerning air and maritime encounters, to which they subsequently added an annex on safety rules for air-to-air encounters. The two countries also committed to implementing the Convention on the International Regulations for Preventing Collisions at Sea, which was established in 1972.

These rules of behavior heavily stress the importance of establishing adequate communication during unplanned encounters at sea, but they have limitations. When submarines are surfaced, they should comply with such rules, but one complication is that when they are underwater, these rules would be irrelevant. Even more problematically, such rules cannot easily be extended to cover unmanned military systems. For instance, compared with manned platforms, unmanned systems are usually designed to be smaller, to be more secretive, and to operate closer to enemy forces. These differences make it more difficult for the two sides to agree on the meaning and implementation of certain CUES provisions, including one that requires vessels to maintain a "safe distance."[227] Another major challenge is communication. Many of the existing communication procedures listed in the CUES—such as the use of sound, light, flag signals, and radio communications—could not be easily implemented with an unmanned system, even if a UUV was piloted remotely, let alone if it could operate autonomously.

Without viable communication mechanisms, Chinese forces protecting SSBNs would have greater difficulty understanding the intentions of U.S. UUVs or USVs.[228] During either peacetime or a military crisis, China would have every incentive to interfere with any foreign unmanned system that it detected and that, in its view, posed a potential threat to its SSBNs. After all, clarifying the intentions of unmanned systems would take time (if doing so were somehow possible), and Chinese military commanders might not want to put the SSBNs at risk by waiting to establish communication.

In a scenario in which Chinese forces believed one of their SSBNs was threatened, they would face only two realistic options: either leaving the foreign UUV or USV alone—potentially putting the SSBN at risk—or using physical force to disrupt the unmanned foreign system's operations, whether by capturing it or by attempting to destroy it. In such a case, it would be very difficult for China to signal that its intentions were defensive. Washington, in turn, could interpret Chinese interference with a U.S. UUV or USV as a provocation or the use of force, especially during a crisis.

Indeed, Beijing has recently signaled its willingness to interfere with unmanned systems. After the December 2016 incident in which a PLA Navy ship seized a U.S. UUV in the South China Sea, an article published through an account managed by the overseas edition of the *People's Daily* argued that there is currently no international law that regulates the maritime activities of unmanned systems. This line of reasoning states that, unlike manned vessels, unmanned systems do not enjoy a right to freedom of navigation and, therefore, "in this grey area, as long as the United States dares to send its underwater drones [to China's coastal waters], China certainly has the right to seize them."[229]

IMPLICATIONS FOR ARMS RACE STABILITY

Although many analysts have emphasized the huge potential for unmanned systems to contribute to ASW missions, unmanned technologies could be employed to help protect SSBNs as well. In fact, there is no clear evidence that unmanned technologies disproportionately favor ASW. Some Western analysts have voiced the view that new technologies might "make the oceans effectively transparent,"[230] but most Chinese experts do not seem to believe that unmanned systems (along with advanced sensors) will inherently change the fundamental existing offense-defense balance in the underwater domain. The effects of such systems seem to depend on how each side invests in new technologies and which side uses them best. This perception further motivates increasing investments to win this emerging competition.

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In particular, Chinese experts have paid a great deal of attention to the potential ways unmanned systems could protect SSBNs based on a concept called network-centric warfare, an idea first framed by the U.S. military and systematically studied by the PLA.[231] Unmanned systems could serve as useful nodes for information collection and communication purposes in a Chinese network-centric strategy for detecting enemy ASW forces and protecting Chinese SSBNs. For example, an SSBN could deploy and use small, quiet unmanned systems to greatly enhance its ability to detect enemy SSNs and other ASW forces, providing itself with an early warning capability that could provide enough time and space for the SSBN to hide and escape.

Alternatively, UUVs could enhance an SSBN's situational awareness by rising close to the surface and communicating with satellites, surface ships, and other friendly forces; the UUVs could then transmit information from these assets to the SSBN, which could remain deeper underwater, using fiber-optic cable or acoustic communications. This approach would allow SSBNs to avoid communicating directly with friendly forces, thus reducing the chances of having the submarine detected by an enemy.[232]

Moreover, China could use UUVs and USVs to interfere with an enemy's ASW platforms. For example, unmanned assets could disrupt communications among an enemy's forces, leaving them unable to effectively coordinate and, thus, undermining their overall ASW capability. Another approach would be for UUVs to emulate the sound profile of an SSBN and try to divert enemy forces from actual ones.[233] Chinese experts have even proposed, without offering operational details, that very large UUVs could function as SSBN decoys to confuse the enemy and perhaps even destroy opposing ASW forces by luring them into traps.[234] That said, the downside of using large numbers of UUVs to help an SSBN is the risk that some of them might inadvertently reveal information about the general location of the SSBN.

In light of the uncertainty about whether offensive or defensive applications of unmanned systems will prove more decisive, many Chinese experts generally acknowledge that China has not been the frontrunner in this competition. Xu Yuru, an academician (the highest academic title for Chinese scientists) in the Chinese Academy of Engineering and a leading Chinese expert on unmanned marine vehicles, stated in the late 2000s that China's research on unmanned surface vehicles had "just got[ten] started" and that the preliminary research at that time was focused on USVs with very simple functions.[235] In 2008, he pointed out that there was a clear gap between Chinese technology and international cutting-edge technology—especially in the areas of underwater navigation, detection, communication, and sensing. Xu called on the Chinese government to draft a systematic plan for developing unmanned marine vehicles.[236] By 2012, according to other experts, China's research and development efforts into unmanned marine vehicles were still at the stage of "conceptual design" and revealed a "relatively big gap with the United States and other advanced countries when it comes to key technologies."[237]

If these assessments are accurate, China's SSBNs may face a growing near-term threat from enemy unmanned systems but, in the long run, the overall impact of unmanned systems on the offense-defense competition may become less clear-cut as China catches up technologically. When China seized a U.S. UUV in December 2016, this further convinced Beijing that it cannot afford to lose the race to counter enemy unmanned military systems and that China should invest in developing its own capabilities. Many Chinese commentators believe

> the PLA's offshore superiority would be greatly advanced, if China could use its advanced underwater communication technology and its leading industrial manufacturing capacity to mass produce unmanned underwater vehicles and to build a set of networks for all dimensional underwater surveillance and combat in the coastal waters before the United States could do so.[238]

Some Chinese commentators have gone so far as to assert that the intensified competition involving unmanned underwater technologies between the United States and China means that the two countries have already entered into a new arms race.[239]

ADDRESSING FUTURE CHALLENGES

GIVEN THAT CHINA seems to be developing sea-based nuclear weapons mainly to strengthen its second-strike capability, the country's SSBNs by themselves should not pose a radically new security threat to any country. That said, countermeasures to China's SSBN program undertaken by the United States and other countries as well as Chinese efforts to protect its SSBNs could still foster unstable crisis and arms race dynamics. Beijing, Washington, and other regional parties should, therefore, aim to mitigate these negative interactions and contain their impact on regional security.

Countermeasures to China's SSBN program undertaken by the United States and other countries as well as Chinese efforts to protect its SSBNs could still foster unstable crisis and arms race dynamics.

As in the case of the escalation risks associated with encounters between SSBNs and ASW assets, the historical record of the Cold War provides useful lessons for how to mitigate these risks. Indeed, Soviet and U.S. scholars explored various potential risk-mitigation measures. Some of their efforts focused on the possibility of formal arms control agreements designed to reduce the threat posed to SSBNs and to minimize the risks of confrontational encounters. These measures included prohibiting the use of active sonar, prohibiting the construction of extensive underwater hydrophone systems, establishing SSBN sanctuaries, and limiting the number of deployed attack submarines.

Unfortunately, the U.S. and Russian governments never endorsed these formal arms control proposals. Some of the measures would have entailed formidable verification challenges or contradicted the U.S.-supported principle of freedom of navigation. Some of them would have imposed restrictions that would have seriously undermined civilian or legitimate activities by third parties. Others would have benefited the two states unequally.[240]

This historical experience suggests that any practical efforts to reduce the escalation risks associated with encounters between SSBNs and ASW assets cannot start with formal arms control measures that demand stringent and complex verification regimes. Furthermore, these efforts should avoid unintended interference with third party activities and should offer mutual benefits to all parties involved. Given these constraints, China, the United States, and U.S. allies should focus first on modest but practical confidence-building measures instead. Such steps should start with reassurances about each side's strategic intentions, placing self-imposed limits on potentially escalatory activities, and establishing confidence-building measures and clear rules of the road for maritime encounters.

A U.S. POLITICAL COMMITMENT TO RESTRAIN STRATEGIC ASW

One important step the United States can take is to commit to refraining from conducting strategic ASW against Chinese SSBNs. U.S. political leaders should not let the country's military make decisions about whether the United States should develop a strategic ASW capability against China, because such a military-driven decision would likely be based on tactical incentives or problematic assumptions about escalation control. On this critical issue, U.S. political leaders need to provide clear top-down guidance to players at the operational level.

One important step the United States can take is to commit to refraining from conducting strategic ASW against Chinese SSBNs.

Some U.S. experts have acknowledged that conducting strategic ASW against the Soviet Union during the Cold War was a problematic strategy and that repeating this strategy against Chinese nuclear-armed submarines today would be counterproductive. After analyzing U.S. strategic ASW policies against the Soviet Union during the 1980s, for instance, the U.S. political scientist Barry Posen concluded that "political management" was needed on this issue to avoid a catastrophe.[241] Similarly, U.S. decisionmakers today need to recognize that, because of the risks of escalation, in particular, developing a strategic ASW capability against China does not serve the strategic interests of the United States. U.S. political leaders must ensure that the U.S. Navy's actions reflect this decision.

There is some question of what form such a U.S. political commitment would take. Ideally, the United States would state publicly that it is not in the national interest to conduct

strategic ASW against China and that the U.S. military does not and will not do so. If an open declaration is not possible, Washington could convey this message in private meetings with Chinese decisionmakers. Such a political commitment would not completely address Chinese concerns, but it would help mitigate them and could provide an incentive for China to refrain from adopting aggressive SSBN operation strategies, such as pre-delegating launch orders, keeping as many SSBNs as possible on patrol during peacetime, or employing overly aggressive pro-SSBN tactics.

That said, the U.S. government has been reluctant to openly acknowledge mutual nuclear vulnerability with respect to China, not least because of concerns that such an acknowledgment could undermine the credibility of extended nuclear deterrence commitments to U.S. allies. A fallback option would be for Washington to publicly recognize the role of China's sea-based nuclear forces in enhancing strategic stability. Such an acknowledgment might go some way to clarifying U.S. intentions and mitigating Chinese concerns. Moreover, this second option would not constitute a significant departure from existing U.S. policy, given that the United States has long viewed its own SSBN forces as playing an important role in maintaining strategic stability.

MAIN POLICY TAKEAWAYS

- U.S. political leaders should decide against pursuing strategic ASW against China and give clear guidance to the military on that basis.
- Ideally, the United States should openly declare—or else state privately—that it is not in the U.S. interest to conduct strategic ASW operations against China and that the United States will not do so.
- If that is not possible, the United States should acknowledge that it recognizes the role of China's sea-based nuclear forces in enhancing strategic stability.

CHINESE TRANSPARENCY MEASURES TO REDUCE FOREIGN THREAT PERCEPTIONS

For its own part, Beijing should convey a clear message to the United States and the rest of the international community that the addition of sea-based ballistic missiles to China's nuclear arsenal is aimed only at maintaining a credible second-strike capability and that SSBNs do not and will not change China's overall approach to nuclear weapons. Beijing

should emphasize that it will stick to its long-standing principle of possessing a "lean and effective" nuclear arsenal, a commitment made in China's previous defense white papers.

Despite a tradition of maintaining a high degree of secrecy about its nuclear capabilities, China has become somewhat more transparent in recent years about some of its capabilities, particularly its SSBNs.[242] Official press reports about SSBN activities have become more frequent. PLA- and government-affiliated experts frequently discuss relevant developments on official television programs. SSBNs have made more frequent appearances in China's large-scale maritime military parades. Additionally, China has unveiled advanced submarine building facilities. Meanwhile, unofficial but detailed information about SSBNs is widely discussed on the internet and social media platforms, without being blocked by the government. This modest increase in Chinese transparency represents a positive trend that has been largely motivated by a perceived need to enhance deterrence.

Beijing should convey a clear message to the United States and the rest of the international community that the addition of sea-based ballistic missiles to China's nuclear arsenal is aimed only at maintaining a credible second-strike capability.

Now, in addition to showcasing its growing capabilities, China should consider how it can reassure other countries—especially the United States—about its defensive, peaceful intentions to forestall overreactions. To this end, China could make the purpose of its growing SSBN forces clearer to mitigate U.S. concerns that these forces could be used for aggressive purposes or could enable Beijing to adopt a less restrained nuclear posture. Greater Chinese transparency about its SSBN forces would help address U.S. concerns about Chinese strategic intentions or operational doctrines and would, therefore, reduce U.S. incentives to pursue preventive activities to counter Chinese SSBNs.

Specifically, China could seek to reassure the United States and its allies about the limited nature of its long-term SSBN development plans. China's introduction of four 094-class SSBNs has already almost doubled the total number of Chinese ballistic missile launchers capable of reaching the U.S. homeland (recall figure 1). An unknown number of additional 094-class SSBNs are under construction, even as China is developing a next generation 096 class of SSBNs. Not only is the total planned number of this new class of SSBNs unknown, but it is possible that the 096-class submarine will carry more SLBM launchers than the 094-class model. Moreover, some analysts have speculated that these SLBMs will be armed with multiple independently targetable warheads.[243] Given these developments, it is unsurprising that foreign experts worry about the rapid expansion of China's SSBN forces and the potential that this expansion will lead to significant changes in China's overall nuclear capabilities and posture.

To reduce such foreign concerns, Beijing might not have to reveal the precise number of SSBNs it intends to build or disclose detailed technical capabilities about its SSBNs, although such information would be helpful. A more feasible approach would be for China to declare the operational requirements for its SSBN fleet. To this end, China could consider outlining the key factors taken into consideration when Beijing decides the qualitative and quantitative requirements for building a survivable SSBN fleet. Such information would help China demonstrate that its SSBN development is not open-ended, is not driven primarily by the availability of resources, and is guided by clear and defensive principles.

Such limited disclosures would help Beijing stress the important connection between developments in foreign strategic ASW capabilities and those of China's own SSBN fleet. In this sense, any relevant information China can provide would offer incentives for other countries to work with Beijing to address its security concerns. For example, given the view of some U.S. experts that Washington needs to build more SSNs to counter China's growing SSBN capability, it would be in both countries' interest to talk candidly about their respective programs so as to avoid an arms race based on worst-case assumptions.[244]

MAIN POLICY TAKEAWAYS

- China should explicitly declare that its SSBN fleet is aimed only at maintaining a credible second-strike capability and that it will not change China's overall approach toward nuclear weapons.
- Beijing needs to reassure the international community that its SSBN development is not open-ended or primarily driven by the availability of resources, but instead is guided by clear and defensive principles.
- China should consider revealing the operational requirements for its future SSBN fleet, that is to say, the key factors that Beijing takes into consideration in deciding the qualitative and quantitative requirements for building a survivable fleet.

JOINT EFFORTS TO BUILD CONFIDENCE ABOUT ASW OPERATIONS

If the United States were willing to refrain from conducting strategic ASW against China, it would still face the challenge of distinguishing Chinese SSBNs from Chinese attack submarines. China would surely not enact far-reaching measures of its own, such as declaring separate operating areas for its SSBN and attack submarines, to help U.S. personnel draw this distinction clearly. China's level of interest in making its SSBN operations distinguish-

able would be very much influenced by its degree of confidence in the U.S. commitment not to deliberately undermine China's SSBN forces.

If the two countries could build some mutual confidence, there are additional measures both sides could take to further reduce the risks of potential misunderstanding and inadvertent escalation. The two states could start discussing whether there are realistic steps that China could take to make attack submarines and SSBNs more distinguishable without undermining their survivability. For instance, Beijing could refrain from allowing its attack submarines to use sound simulators that mimic SSBNs.[245] (It is not known publicly whether China has developed or deployed such a technology but, if it has not yet, it may do so in the future.) Potential Chinese commitments like this would not be technically verifiable, but they could help demonstrate to the United States that China recognizes the security benefits of making nuclear and non-nuclear forces distinguishable. Such steps could be implemented as part of mutual cooperative efforts to increase operational transparency.

For its part, Washington should seek to make its tactical ASW operations less likely to be mistaken for strategic ASW activities. For instance, the United States could refrain from large-scale deployments of ASW forces in the South China Sea when U.S. carriers or other high-value surface ships are not present. The deployment of major ASW assets can be justified if high-value U.S. surface ships are operating in Chinese coastal waters where they might be threatened by Chinese attack submarines. But if such surface ships are not present—and they sometimes are not—China could reasonably infer that large-scale U.S. ASW deployment would be targeting its SSBNs.

Beyond the issue of distinguishability, the United States should avoid deliberately threatening Chinese SSBNs for the purpose of distracting Chinese attack submarines. That U.S. approach against the Soviet Union during the 1980s was thought to be a suboptimal way of achieving the goal of protecting SLOCs in the Atlantic Ocean.[246] Using this tactic against China would be a recipe for both short-term crisis instability and long-term arms race instability. The more that U.S. operations appear to threaten Chinese SSBNs—for whatever reason—the more anxious Chinese decisionmakers will be, increasing the risks of escalation in a conflict. In the long run, such U.S. tactics would only encourage China to build more SSNs to protect its SSBNs and to conduct other offensive missions.

In addition, the United States should consider refraining from deliberately disrupting the C3 systems associated with Chinese SSBNs. In recent years, China has shown reasonable concerns about the reliability of these systems, especially their potential vulnerability to outside interference.[247] A leaked classified document produced by the U.S. National Security Agency in 2001 acknowledges the United States' "ability to acquire and locate signals associated with PRC submarines."[248] Furthermore, this document claims that the United States has "knowledge," derived from signal intelligence, of the "organization, platforms, missile testing operations, and communications" associated with China's SLBM program.

If the communications channels associated with Chinese SSBNs are vulnerable to interception, they may be vulnerable to interference too. Indeed, there have been reports that, on an unknown date, U.S. airplanes, including an EA-6B electronic warfare aircraft, disrupted communications with a Chinese nuclear submarine (probably an SSN) that was participating in a military exercise in the Yellow Sea, after the submarine had been tracked by a U.S. antisubmarine aircraft.[249] Chinese electronic communications and combat systems were paralyzed, leading China to scramble fighter jets from its naval aviation forces to intercept the U.S. electronic warfare aircraft. Because Chinese SSNs and SSBNs may share the same communications systems, or similar ones, this incident has fueled Chinese concerns about apparent U.S. interest in interfering with its SSBN communications and its ability to actually do so.

In peacetime, U.S. efforts to explore potential vulnerabilities in the C3 systems of Chinese SSBNs would exacerbate Beijing's suspicions that Washington is not really committed to bilateral strategic stability and instead is seeking to neutralize China's nuclear deterrent. This suspicion could fuel a long-term arms race that benefits no one. During a crisis, U.S. efforts to interfere with the C3 systems of Chinese SSBNs could lead Beijing to suspect that Washington may be about to launch a disarming first strike, which could then prompt China to initiate escalatory countermeasures preemptively.

Until China has built dedicated and distinguishable C3 systems for the SSBN fleet that are separate from the C3 systems used by SSNs, the United States may need to exercise precautions against interfering with such shared C3 systems across the board. This would undermine some of the U.S. tactical ASW capabilities under certain circumstances, but given the escalation risks, it may still be worth considering.

MAIN POLICY TAKEAWAYS

- The United States and China should discuss whether there are other realistic ways for Beijing to make its attack submarines and SSBNs more distinguishable without undermining their survivability and for Washington to make its tactical ASW operations less likely to be mistaken for strategic ASW.
- Washington should refrain from large-scale deployments of ASW forces in the South China Sea when U.S. carriers or other high-value surface ships are not present.
- The United States should avoid using the tactic of deliberately threatening Chinese SSBNs to prevent Chinese attack submarines from being able to conduct offensive operations. Similarly, Washington ought to refrain from deliberately disrupting the C3 systems associated with China's nuclear forces.

JOINT EFFORTS TO ESTABLISH CLEAR RULES OF THE ROAD

Clear rules for maritime encounters between the naval vessels of China, the United States, and other regional actors that build on previous guidelines would be beneficial for strategic stability. Unfortunately, existing maritime safety rules—both multilateral and bilateral ones—do not easily apply to submarine operations due to the extreme secrecy of these underwater vessels. That said, established rules do have implications for the general-purpose forces used to track or protect SSBNs. Reducing the likelihood of confrontations between ASW forces and those used to protect SSBNs could help lower the risks of escalation in the waters of the Asia Pacific, particularly in the South China Sea.

Clear rules for maritime encounters between the naval vessels of China, the United States, and other regional actors that build on previous guidelines would be beneficial for strategic stability.

Relevant stakeholders—especially the United States and China—should, therefore, seek to negotiate clear rules concerning the interactions of such forces, including surface vessels and aircraft. U.S. and Chinese military leaders managed to make initial progress in 2014 and 2015 by establishing basic rules of behavior for unplanned surface-to-surface and air-to-air encounters.[250]

Nonetheless, these rules are probably too general and abstract to prevent dangerous encounters between the two militaries. For instance, according to these rules, the "actions that the prudent commander (commanding officer) or master general should avoid" include "aerobatics" and the "unsafe approach" of one vessel to another.[251] But these terms are not defined. As a result, such general statements have not been very effective at reducing the frequency of dangerous encounters in the past couple of years.

To reduce escalation risks substantially, the two militaries need to build on the 2014 and 2015 agreements by drafting more detailed rules. Although attack submarines sometimes play an important role in both ASW and SSBN-defense operations, it might be unrealistic—given the extremely secret nature of their operations—to include them in any set of rules in the near term, as desirable as it would be to do so. That said, private conversations with senior U.S. naval officers indicate that closed-door discussions between U.S. and Chinese experts about cooperative measures to enhance safe submarine operations are both necessary and feasible.[252]

In addition, the United States and China should start discussions on establishing rules of the road for new potentially destabilizing technologies. The increasing use of unmanned systems is a case in point. Advanced UUVs and USVs could potentially threaten the survivability of SSBNs, especially as sensor technologies improve. Moreover, UUVs and USVs are useful for disrupting the operations of forces that defend or threaten SSBNs.

China's view is that, under international maritime laws, the status of unmanned vehicles, including any entitlement to sovereign immunity from foreign jurisdiction, is unclear.[253] This leaves significant room for a country to use or attack unmanned vehicles without effective constraints.

Because both the United States and China are making major investments to develop unmanned vehicles, the two countries' share an interest in jointly exploring possible rules of the road to regulate the activities of unmanned vehicles and their interactions with manned systems. At the minimum, Beijing and Washington can start discussing what the legal status of unmanned vehicles should be, when UUVs should be legally protected from meddling by other countries, and what improvement can be made to current international laws to address such new concerns.

Ideally, rules would be negotiated in the near future before UUVs are deployed en masse. To this end, the two militaries could conduct tabletop exercises during official and/or unofficial dialogues to elicit more nuanced understandings about the potential risks associated with various employment strategies. Insights gained from such exercises could be used to help develop unilateral and cooperative risk-reduction measures. In addition, once armed UUVs are deployed, confidence-building measures—such as commitments to exercise unilateral restraint in using UUVs to conduct hold-at-risk operations against SSBNs—would be very helpful.

MAIN POLICY TAKEAWAYS

- China and the United States should seek to negotiate more detailed and specific rules to regulate interactions between U.S. ASW forces and Chinese general-purpose forces used to protect SSBNs.
- U.S. and Chinese experts should conduct private discussions about cooperative measures to enhance safe submarine operations.
- The two countries should initiate discussions to jointly explore possible rules of the road to regulate the activities of UUVs and USVs and their interactions with manned systems.
- The U.S. and Chinese militaries could conduct tabletop exercises in official and/or unofficial dialogues to develop more nuanced understandings of the potential risks associated with various UUV employment strategies to stimulate the development of risk-reduction measures.

CHINESE REASSURANCES TO OTHER REGIONAL PLAYERS

The United States and China are not the only stakeholders in the Asia Pacific, and Beijing should seek to reassure other regional countries. Given that Chinese SSBNs currently operating in China's coastal waters cannot directly threaten the U.S. homeland, some U.S. allies—Japan and South Korea, in particular—might worry that they are potential targets. After all, in a hypothetical war over Taiwan—the most likely scenario for a serious U.S.-China military conflict—the United States would need logistical support from Japan and South Korea (among other allies). Tokyo and Seoul may worry that China would attempt to deter them from providing such support by threatening a nuclear attack. From Beijing's perspective, such concerns are unfounded, because such a threat would directly contradict China's unconditional NFU policy and its commitment to never threaten non-nuclear-weapon states with nuclear weapons. In light of these considerations, China should be willing to explicitly rule out nuclear attacks on Japan and South Korea.

Aside from fears stoked by China's nuclear weapons themselves, forceful Chinese operations to protect its SSBNs in the South China Sea could be seen by other regional countries, including ASEAN members, as evidence of China's aggressive or expansionist policies. Such perceptions could motivate these countries to align more closely with the United States in an effort to balance China. It is, therefore, in China's interest to show that it is not pursuing a comprehensive sea-control capability in the region, but instead is simply aiming to achieve the limited defensive goal of protecting its sea-based nuclear deterrent capabilities from the United States.

Beyond formulating clearer rules with the United States to regulate naval encounters between anti-submarine and supporting assets, China should work directly with regional countries too. If Beijing feels it is necessary to set up and protect SSBN bastions in the South China Sea, it should try to reach common understandings with other regional actors about which specific activities aimed at achieving this goal are permitted. Beijing should formally renounce overly aggressive pro-SSBN activities that clearly jeopardize the legitimate security interests of others.

More importantly, any Chinese efforts to be more transparent about its development and deployment plans for its SSBNs could help reassure other regional actors. As China's SSBN capabilities continue to grow, it will be beneficial for Beijing to regularly reaffirm its unconditional NFU nuclear weapons policy and to categorically renounce any plans to use nuclear weapons for any mission other than nuclear counterattack. Such reassurances would reduce the potential interest of regional countries in conducting aggressive ASW operations against Chinese SSBNs or in joining U.S. efforts to do so.

Beyond that, China should consider signing and ratifying the protocol to the Southeast Asia Nuclear-Weapon-Free Zone Treaty sooner rather than later. The protocol would require the five nuclear weapon states recognized by the NPT to respect the nuclear weapon–free status

of Southeast Asia and provide negative security assurances to its members. A close reading of the provisions of the treaty and its protocol shows that these provisions would not necessarily undermine China's right to operate SSBNs in areas covered by the treaty, regardless of whether existing territorial disputes in the region are resolved.[254] ASEAN members have repeatedly called on nuclear weapon states to sign and ratify the protocol. If China were to do so soon, that would further demonstrate Beijing's intention not to threaten ASEAN countries with nuclear weapons and its commitment to work with ASEAN countries to advance the common goal of peace and stability in Southeast Asia.

MAIN POLICY TAKEAWAYS

- China should aim to reassure regional states that it is not pursuing a comprehensive sea-control capability in the region but is instead simply aiming to achieve the limited and defensive goal of protecting its sea-based nuclear deterrent vis-à-vis the United States.
- Countries in the region should work toward reaching some common understandings on what specific Chinese military activities are legitimate for protecting SSBNs.
- China could be more transparent about the development and deployment plans for its SSBNs operating in the South China Sea.
- Beijing should reaffirm its unconditional NFU policy on a regular basis and categorically renounce any plans to use nuclear weapons in any missions other than nuclear counterattack, including by explicitly ruling out nuclear attacks on South Korea or Japan.
- China should consider signing and ratifying the Protocol to the Southeast Asia Nuclear-Weapon-Free Zone Treaty sooner rather than later.

UNILATERAL MEASURES FOR CHINA TO CONSIDER

In addition to cooperative or reciprocal confidence-building measures, there are unilateral steps that China could take to ensure its SSBNs fulfill their strategic objective of enhancing nuclear deterrence without causing unnecessary instability or undermining China's own interests. These unilateral policy recommendations pertain to the ways China builds and employs its SSBNs and therefore can be taken regardless of whether the aforementioned reciprocal measures materialize.

Adopt a Temperate Patrol Strategy:

There is no need for Beijing to maintain a continuous-at-sea deterrence posture during peacetime, because there is no realistic possibility of China being attacked, without warning, by a sudden nuclear strike. Moreover, China faces no non-nuclear existential threats, except over Taiwan, and even in that case Beijing's NFU pledge would still apply.[255] Additionally—unlike the UK, which does maintain a continuous-at-sea deterrent—China has other elements in its nuclear arsenal, including land-based nuclear missiles (which traditionally have constituted the backbone of its nuclear deterrence capabilities) as well as improving airborne nuclear capabilities.

There are unilateral steps that China could take to ensure its SSBNs fulfill their strategic objective of enhancing nuclear deterrence without causing unnecessary instability or undermining China's own interests.

As a peacetime alternative to continuous-at-sea deterrence, China could conduct occasional patrols to ensure that the crews remain proficient and that the submarines stay in good working order. If a crisis emerged, Beijing could send its SSBNs to sea to conduct patrols. A crisis, especially one serious enough to prompt China to alert its SSBN forces, would almost certainly take time to build up. If Beijing can keep its crews well trained and its submarines well maintained, it would always have the option of flushing its SSBNs at the first sign of a potential military crisis.

The most common counterargument to this posture is that, if a country does not maintain continuous-at-sea deterrence, sending SSBNs to sea during a crisis could be misunderstood by an adversary as an act of escalation. This is a reasonable concern, but there are ways to mitigate the problem. For instance, China could conduct its peacetime patrols irregularly without any discernable deployment pattern. That way, an adversary would not be able to determine whether a patrol during a crisis was routine or a response to the situation. Moreover, SSBN patrols would only be escalatory if they were detected, and it is uncertain if potential adversaries can always monitor the movements of China's SSBNs. To increase the likelihood that the United States would not detect SSBN movements in a crisis and so mitigate the problem of unintended escalation, China could adopt a wide range of concealment and deception tactics, if it does not do so already. The Hainan submarine base, for example, is reported to include underground facilities built inside the island's hills and is thought to have underwater exits for submarines to leave the facilities without being detected.[256]

Conducting strategic patrols less frequently would have other additional benefits, including conserving nuclear fuel for submarine reactors. This is probably not a trivial consideration given that refueling submarine reactors is a time-consuming, expensive process. Submarines have no military utility while they are being refueled, a process that typically involves cutting the submarine open. The U.S. Ohio-class SSBN, for example, requires a four-year,

mid-life overhaul, including a two-year refueling period.[257] (Future U.S. Columbia-class SSBNs will be equipped with a life-of-the-ship core, but it seems unlikely that China's 094-class submarines have this capability.)

MAIN POLICY TAKEAWAYS

- China does not need to maintain a continuous-at-sea deterrence posture during peacetime.
- Beijing should conduct its peacetime patrols on an irregular basis without showing any discernable pattern of deployments.
- China can take a wide range of concealment and deception tactics to mitigate the problem of unintended escalation when deploying SSBNs during a crisis.

Keep SSBNs on a Moderate Alert Status:

Aside from patrol frequency, China does not need to keep its SSBN forces on high alert during peacetime. On peacetime patrols, Beijing could maintain deterrence without always arming its SLBMs with nuclear warheads or even without having its SSBNs always carry SLBMs. As long as China did not reveal whether its SSBNs carried missiles, or whether the missiles carried warheads, potential enemies would have to assume that they did. In practice, therefore, China could occasionally choose to arm its patrolling SSBNs with missiles and warheads depending on the situation. This approach would not undermine the credibility of China's sea-based nuclear deterrent during peacetime, but it could reduce the dangers associated with always carrying real warheads and the consequences of incidents at sea involving SSBNs. If military tensions built up, a prospect that generally takes time to unfold, China could start arming all the SSBNs it sent out on patrol.

One potential concern is that such a strategy could increase inadvertent escalation risks. This strategy would rely on China's ability to successfully conceal which SSBNs were armed—concealment efforts that might not always succeed. Occasionally, an adversary might detect missiles and warheads being loaded into submarines in port. If this happened during a security crisis, the adversary might misinterpret these actions as Chinese preparations for nuclear use, whereas, in fact, China would simply be taking precautions. Once again, though, this risk could be mitigated by dedicated efforts—such as the use of reported underground submarine facilities—to securely hide such activities from outside observers.

Additionally, China's leaders need to decide what an SSBN should do if communications were lost during a serious crisis. If Chinese military plans require that SLBMs be targeted at

cities and industrial hubs, then there would be no need for an SSBN to launch its missiles in haste if communications broke down. Such targets are stationary, and it would make sense for the SSBN in question to wait until communications were restored before taking action. That said, it is possible that, during a communications blackout, a submarine could face an imminent and serious threat of enemy attack.

Chinese leaders would need to decide whether to pre-delegate launch authority to SSBN commanders in such a scenario and, if so, how. To reduce the need to pre-delegate and to narrow the situations in which SSBN commanders would be granted launch authority, it is crucial for China to develop high confidence in the survivability of its top leadership and the C3 systems that its nuclear forces, including its SSBNs, rely on. Attaining such confidence will require Beijing to develop a highly secure, reliable, and redundant C3 system. China already seems to be on the path to doing so, by utilizing SLF radio communications, conducting research into ELF radio communications, developing an airborne C3 system, and exploring satellite communication technologies, among other measures.[258]

Improving the C3 system for Chinese SSBNs will be a time-consuming and incremental process, and setbacks are likely. As a point of comparison, in the mid-1990s, the U.S. Navy reportedly discovered a serious new threat to an SSBN communications system and took drastic steps to redesign launch procedures for its SSBN crews.[259] In a similar way, China will inevitably go through a lengthy period of learning and adaptation as it seeks to develop an effective C3 system for its SSBNs. In the meantime, the United States and other relevant countries could help reduce Beijing's incentives to pre-delegate launch authority by pledging to not deliberately disrupt or interfere with China's C3 system. Such a commitment would incentivize China to prioritize efforts to prevent the unauthorized launch of sea-based nuclear weapons.

MAIN POLICY TAKEAWAYS

- China does not need to keep its SSBN forces on high alert during peacetime. It could maintain deterrence without always arming its SLBMs with nuclear warheads or even without having its SSBNs always carry SLBMs on peacetime patrols.
- Beijing should prioritize ensuring against the unauthorized launch of sea-based nuclear weapons. A robust C3 system is very important for achieving this goal and for avoiding the need to pre-delegate launch authority.

Avoid Nuclear and Conventional Entanglement:

China can further limit crisis instability by delineating between its nuclear and conventional naval assets as clearly as possible. Although it is common for senior PLA naval experts to envision future SSBNs as integrated platforms that deploy both nuclear and conventional weapons, Chinese SSBNs should remain exclusively dedicated to the nuclear mission. The risk of inadvertent escalation from deploying both nuclear and conventional weapons on SSBNs is too high and would outweigh any potential military gains. Moreover, the seemingly widespread view among some Chinese experts that future SSBNs are trending toward becoming platforms that host nuclear weapons, conventional weapons, and even missile defense interceptors is based on a misreading of foreign national security plans.

Contrary to the views of these Chinese experts, the United States is somewhat aware of the problems associated with nuclear-conventional entanglement and has, in recent years, taken measures to avoid mixing nuclear and conventional weapons on the same platforms. In the mid-2000s, the U.S. Congress rejected funding for the Conventional Trident Modification program (which sought to replace nuclear warheads with conventional ones on some Trident D5 missiles).[260] This ambition was abandoned out of concerns that potential adversaries might mistake the launch of a conventionally armed Trident for a nuclear-armed missile, leading to inadvertent escalation. Moreover, while the U.S. Navy does deploy conventional cruise missiles on four Ohio-class submarines, those vessels have been converted to designated cruise missile submarines and no longer carry any nuclear weapons.

It is in Beijing's interest to learn these same lessons. If China is concerned that SSBNs have limited military utility, it should limit the number that it builds. Putting conventional missiles on SSBNs to make them purportedly well-rounded platforms (or, for that matter, arming SSNs with nuclear cruise missiles) may be cost effective, but it is also strategically risky.

An even more pressing issue is the likely entanglement of nuclear and conventional C3 systems for naval forces. Despite the lack of definitive evidence, it is probable that current Chinese SSBNs share some command, control, and communications systems with nonnuclear forces. For instance, some radio broadcast systems may be used for communicating with both SSBNs and attack submarines. If such dual-use C3 systems were attacked in a conventional conflict, the risk of misinterpretation would be real. Ideally, countries would make their C3 systems for SSBNs completely separate from their C3 infrastructure for other naval platforms, including attack submarines.

In practice, however, doing so might be technically, logistically, and financially challenging. A more viable alternative for China might be to deploy one or more SSBN-dedicated C3 systems, alongside other dual-use C3 systems shared by SSBNs and some general-purpose forces. Such dual-use capabilities could increase redundancy in useful ways. Furthermore, a dedicated C3 system could reduce Chinese concerns about losing effective control over its SSBNs, in the event that some dual-use systems were attacked in a conventional conflict.

More generally, China should seek to understand the specific risks resulting from C3 entanglement and take them into consideration when formulating procurement policies and operational plans. At present, awareness and appreciation of such risks—especially among senior Chinese military officials and political decisionmakers—is low. China should conduct more internal research to understand and address these dynamics.

MAIN POLICY TAKEAWAYS

- China should recognize that the escalation risks associated with arming submarines with both nuclear and conventional weapons would outweigh any increase in military utility, and it should categorically reject this course of action.
- The Chinese expert community should closely examine the practices of other major nuclear powers to avoid concluding incorrectly that arming submarines with both nuclear and conventional weapons represents an international trend.
- China should conduct internal research to better understand the risks posed by dual-use C3 systems and should ensure that such risks inform procurement policy and operational planning. Beijing should consider deploying a dedicated SSBN C3 system that is separate from the C3 systems for general-purpose forces.

Keep the SSBN Force Lean and Effective:

Beyond these concerns about crisis instability, the ultimate size of China's SSBN fleet has serious long-term implications for arms race stability. Beijing's image as a responsible nuclear power can be best maintained by building a modest SSBN force, in line with the principle of maintaining a lean and effective nuclear force that has guided the development of China's force posture for decades.

Given the very limited number of ICBMs that China currently possesses, each new SSBN represents a substantial addition to China's strategic nuclear capabilities. Such additions could contribute significantly to potential enemies' threat perceptions—particularly if Beijing's SLBMs are, or will be, deployed with multiple warheads. Moreover, if China continues to improve the accuracy of its SLBMs, the first-strike potential of a relatively large SSBN fleet could appear increasingly threatening to China's nuclear rivals, particularly India. The result could be additional pressure on New Delhi to build a larger nuclear arsenal and to reconsider its own existing NFU policy, a development that would have profound ramifications for crisis stability.

Strategically speaking, the optimal size of a country's SSBN fleet should depend on its specific operational strategy. Given its objective of ensuring the overall credibility of its nuclear retaliatory capabilities, China may not need to build a large-scale SSBN fleet. The experts who have proposed fleets of at least eight SSBNs have not elaborated on what deployment strategies would best serve China's military objectives.

If China does not adopt continuous-at-sea deterrence, the four or five SSBNs that it has reportedly already built should be more than adequate for a credible sea-based nuclear deterrent. In fact, given the British and French examples, China may even be able to adopt a continuous-at-sea deterrence posture with its existing fleet—though this claim is disputed by some Chinese experts. Financially, too, China has an incentive to keep its fleet as small as possible, consistent with operational requirements—not least because the cost of operating each SSBN may be greater for China than the equivalent cost to the United States. This is at least partially because U.S. SSBNs rely primarily on stealth for survival and do not need much additional protection (if any) from general-purpose forces. By contrast, current Chinese SSBNs are noisy enough to need greater protection. Especially if Beijing adopts a bastion deployment strategy, it will need to devote significant resources to protecting its SSBNs with general-purpose forces.

Instead of building a large, expensive SSBN fleet when the country faces no serious existential threat, China should consider a smarter, less expensive alternative that would be more conducive for maintaining strategic stability. China could keep its SSBN fleet relatively small for the time being. It could focus its resources on training extra sets of SSBN crews and maintaining a responsive ship-building infrastructure. If the Asia Pacific's geostrategic environment changed radically and China needed more SSBNs to deal with a new threat, the country would have the industrial capability to quickly mass produce a few more SSBNs within several years. The extra sets of crews trained during peacetime would be ready to operate these submarines as soon as they were produced. This hedging strategy deserves serious consideration because any fundamental change in China's geostrategic environment that would require Beijing to enlarge its SSBN fleet would likely take a few years to develop.

If China does choose to keep its SSBN fleet small, it would be in the country's interest to make this decision clear to international observers. Beijing's existing policy of not providing authoritative information about plans for developing China's SSBN fleet leaves room for wild speculation. In August 2016, for instance, a local government-run television network in the coastal city of Huludao broadcasted a story about a top official from the Bohai Shipbuilding Heavy Industry Company inspecting a construction site for a new assembly line. (The story included pictures from inside the facility.)[261] The company's shipyard at Huludao has been the primary construction site for Chinese nuclear submarines, both SSBNs and SSNs. Consequently, foreign and Hong Kong–based observers speculated that China was significantly expanding its submarine building capacity to facilitate a major expansion of its SSBN and SSN fleets.[262] This conjecture was subsequently picked up by

Chinese media outlets with some official standing, including *Cankao Xiaoxi*, the *Global Times*, the *People's Daily* website, and a publication managed by the National Development and Reform Commission.[263]

More in-depth research suggests that this speculation may be based on a false premise. A careful analysis of the foundation of the new assembly hall suggests that this facility is most likely for building high-value commercial ships.[264] To discourage exaggerated foreign threat perceptions, it would behoove China to break with tradition and provide some general but authoritative information about its long-term plans for SSBN development, to the extent that sensitive military information would not be compromised.

In addition to maintaining a moderately sized SSBN fleet, Beijing should limit how many SLBMs it puts on each submarine. As technology and China's geostrategic environment have evolved, the need to deploy many SLBMs on each SSBN has generally declined. In the case of the United States, Ohio-class SSBNs used to have twenty-four operational SLBM tubes, but Washington decided to reduce that number to twenty so as to fulfill its New Strategic Arms Reduction Treaty (New START) obligations.[265] This process was completed in July 2017.[266] Moreover, each next-generation Columbia-class SSBN will have only sixteen missile tubes.[267] Similarly, the UK government announced in its 2010 Strategic Defense and Security Review that it would "reduce the number of operational launch tubes on [UK] submarines from 12 to eight," a policy that will apply to both existing Vanguard-class and next-generation Dreadnought-class SSBNs.[268]

By contrast, some Chinese commentators argue that China should greatly increase the number of SLBMs on each SSBN, from twelve on its 094-class submarines to as many as twenty-four for the next-generation SSBN.[269] Their thinking is that putting more SLBMs on each SSBN would improve cost-effectiveness, but this perspective seems out of touch with both Chinese strategic requirements and international trends. Furthermore, increasing the number of SLBMs on an SSBN reduces the submarine's maximum speed, which could undermine its ability to escape from danger and transit quickly to a patrol area during a crisis.[270] By contrast, an SSBN with fewer SLBM launchers would be smaller, lighter, more flexible, and, thus, more survivable.[271] The comparative loss of any given SSBN would be less significant, which would enhance crisis stability.

MAIN POLICY TAKEAWAYS

- China can obtain a credible sea-based nuclear deterrent without developing a large SSBN fleet.
- China can maintain its image as a responsible nuclear power by keeping its SSBN force lean. To bolster this image, Beijing should proactively provide authoritative information about its SSBN development plans.
- While keeping its SSBN fleet relatively small for the time being, China could hedge against future uncertainties over its security environment by focusing resources on training extra sets of SSBN crews and maintaining a responsive ship-building infrastructure.
- China should not increase the number of SLBMs on each submarine.

These policy recommendations constitute a starting point for China, the United States, and U.S. allies to responsibly manage the risks posed to strategic stability by the growth of China's SSBN fleet and U.S. ASW capabilities. While these suggestions will not completely eliminate the potential risks of crisis instability or an arms race, they are necessary steps to maintain stable U.S.-China nuclear relations and to preserve peace, stability, and security in the Asia Pacific region.

NOTES

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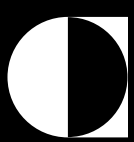

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