

An **UNDERSEA** Deterrent?

By Andrew S. Erickson and Michael Chase



China's investment in a nuclear-powered ballistic-missile submarine force and the accompanying infrastructure indicates a major effort to take the boats to sea.

Increasingly aggressive Chinese harassment of U.S. survey vessels came to a head on 8 March when five Chinese ships surrounded the ocean surveillance ship USNS *Impeccable* (T-AGOS-23), with one Chinese crew member even apparently attempting to snag her towed array with a grappling hook. The *Impeccable* was operating in international waters 75 miles south of China's new Yalong Bay submarine base on Hainan Island, prompting speculation that the Chinese actions represented a coordinated effort to dissuade the United States from monitoring China's latest nuclear-powered submarines and their area of operations. According to Xiamen University South China Sea expert Li Jinming, "It is well known that the submarine base was established [at Hainan], so it is unacceptable for China to have the U.S. Navy snooping around so close." This incident suggests that Beijing may be particularly sensitive about U.S. activities in this region, in part because it appears poised to become the home base of China's second generation of nuclear-powered ballistic-missile submarines (SSBNs), the Type 094, or *Jin*-class.

The emergence of the *Jin* appears to represent a substantial improvement over its first-generation Type 092 *Xia* SSBN. China may build five Type 094 SSBNs, each of which will be outfitted with 12 developmental JL-2 submarine-launched ballistic missiles (SLBMs) that have an estimated range of at least 7,200 km and are equipped with penetration aids.¹ China's single *Xia* is equipped with short-range (1,770 km) JL-1 SLBMs and it is thought to never have conducted an extended patrol.

Although the transition to the new SSBN is ongoing, recent Internet photos depicting at least two *Jin* SSBNs suggest that China has reached an unprecedented level of confidence in the sea-based leg of its strategic nuclear forces. Indeed, China's 2008 *Defense White Paper* states that the People's Liberation Army Navy (PLAN) is enhancing its "nuclear counterattack" capability.² With the introduction of the DF-31 and DF-31A road-mobile intercontinental ballistic missiles (ICBMs) and the JL-2 missiles on *Jin* SSBNs, China is thus on the verge of achieving a credible nuclear deterrent based on a survivable second-strike capability.

Recent Developments

While the exact trajectory and scope of China's SSBN development remains unclear, a variety of data points are emerging. The Office of Naval Intelligence (ONI) assesses that although China built only a single *Xia* SSBN, it will build a "fleet of probably five Type 094 SSBNs . . . to provide more redundancy and capacity for a near-continuous at-sea presence."³ A variety of Chinese publications suggest that the SSBN forces of France and Britain—which have four vessels each, with one at sea at all times, two in refit, and one under maintenance—may serve as models for China and hence possible indications of its plans.⁴ One Chinese source, however, suggests that China will field six 094 SSBNs, divided into patrolling, deploying, and refitting groups.⁵ Consistent with this projection, another source suggests that these groups will comprise two SSBNs each.⁶

It is clear that at least two different hulls have already been launched, based on unusually high-resolution Internet and commercial satellite images that have emerged of one *Jin* in port at Xiaopingdao, two *Jins* in the water and perhaps one emerging from production at Huludao, and one at a newly-constructed submarine facility at Yalong Bay near Sanya on Hainan Island.⁷

Exactly how many different hulls are depicted in these photos remains uncertain, but the images of the facility on Hainan Island appear to provide some hints as to the PLAN's SSBN basing plans. The photo of the *Jin* at Yalong Bay suggests that the facility may be the base for China's future SSBNs. Images available on Google Earth suggest that the Hainan facility, with its more than 23-meter-wide and over 19-meter-high cave entrance, was designed to accommodate larger submarines such as the *Jin*, which appears to be about 148 meters long and 12 meters wide. Google Earth imagery of China's nuclear-powered submarine base at Jianggezhuang (with its approximately 13-meter-wide cave entrance) suggests that its maintenance tunnel may be too narrow to accommodate the *Jin*. There also appear to be few convenient pier locations at other ports for additional submarines. The Hainan facility, by contrast, has three piers and a possible degaussing facility, perhaps offering further rationale for its development as China builds additional submarines.⁸

China's Motives

Many analysts have focused on the survivability issue as the main reason for China's decision to proceed with the development of the *Jin* and the JL-2. Given the potential vulnerability of Chinese SSBNs to detection by adversary attack submarines and the challenges of dispersed road-mobile missiles, however, it would certainly seem that Chinese decision-makers must also have been considering other factors, including countering missile defense, increasing international nuclear prestige, and inter-service politics.

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THE LONE WOLF The progenitor of the Chinese nuclear-powered ballistic-missile submarine force, the Type 092 *Xia*, was paraded before the world during China's international fleet review in April. The second-generation Type 094 *Jin*-class boats remain elusive and were not on display.

Chinese strategists appear to calculate that a nuclear dyad—composed of land-based strategic missiles and SLBMs—is required to enhance the credibility of China’s nuclear deterrent in line with the requirements of the “effective counter-nuclear deterrence” posture discussed in recent Chinese publications. As “the most survivable type of (nuclear) weapon,” an SSBN can allow China to deter third-party intervention in a regional conflict.⁹ Citing the development of the *Jin*, one Chinese source states, “If a war erupts across the Taiwan Strait one day, facing the danger of China waging nuclear



WHATEVER IT TAKES Two Chinese trawlers stop directly in the path of the USNS *Impeccable* (T-AGOS-23) forcing the ship to an emergency “all stop.” This and other actions on 8 March represented a coordinated effort to dissuade the United States from monitoring China’s latest nuclear-powered submarines and their area of operations.

war, it will be very difficult for America to intervene in the cross-strait military crisis.”¹⁰

For more than four decades, China’s stated policy has been that it will never use nuclear weapons first. Although recent statements by some Chinese commentators suggest that this may be under debate, it has nonetheless been reiterated consistently in several major publications on military strategy and doctrine. Accordingly, we interpret the Chinese comments here to mean not that China would be likely to launch nuclear weapons first in response to U.S. intervention in a China-Taiwan conflict, but rather that Chinese analysts believe strong SSBN capabilities would enhance deterrence by causing Washington to think twice about intervening in a conflict in which escalation control might be difficult.

Another explanation for the *Jin* is that Chinese planners believe SLBMs launched from certain patrol areas might complicate U.S. missile-defense interception efforts “by being able to launch . . . along azimuths outside the [systems’] engagement zones.”¹¹ Toshi Yoshihara of the Naval War College contends that “for at least the next two decades, missile defense . . . will have no answer to a capable SSBN patrolling the open ocean.”¹² A Chinese analysis likewise states that SSBNs “are more capable of penetrating [missile] defenses.”¹³

Yet another explanation for the decision to deploy the *Jin* is that Chinese leaders may view the ships as symbols of the PRC’s emerging great-power status. The other permanent members of the UN Security Council—France, Britain, Russia, and the United States—all have modern SSBNs in their fleets, and Beijing may see the deployment of its own as a way to enhance its international pres-

tige. This certainly appears to be true of nuclear-powered submarines in general. One Chinese-published analysis emphasizes the precise correlation between membership in the UN Security Council and the development of nuclear-powered submarines.¹⁴ Similarly, former PLAN Commander Admiral Liu Huaqing and others state that such submarines represent one of China’s clearest claims to status as a “great power.”¹⁵

Another possible explanation that should not be discounted is inter-service politics. Little or no empirical information on this topic is available since the politics of China’s defense budget process are opaque to outsiders. But, it seems reasonable to speculate that the PLAN leadership may have pushed for the development of the *Jin*-class to ensure that the navy would have a role to play in the strategic nuclear-deterrence mission, thereby increasing its share of defense spending.

Operational Challenges

Notwithstanding the considerable progress reflected by the launching of at least two *Jin* SSBNs, the PLAN still faces at least three key challenges before it realizes a secure seaborne second-strike capability: reducing the probability of detection; at sea training of commanders and crew members; and coping with the nuclear command-and-control issues associated with the operation of SSBNs.

Chinese observers are well aware of the challenges of avoiding detection, as reflected by their analysis of capabilities allegedly demonstrated during the Cold War vis-à-vis Soviet submarines. With respect to China’s assessment of the Cold War at sea, one particularly noteworthy

publication is the Chinese translation of a Russian book, *Secrets of Cold War Undersea Espionage*, which alleges that “U.S. nuclear and conventional submarines would often lurk along the routes of Soviet warships . . . conducting intelligence activities.” This volume also claims that “the SOSUS [Sound Surveillance] system substantially helped the U.S. to cope with the capabilities of the Soviet submarine force,” and credits the United States with building an “acoustic signature catalogue (resembling a fingerprint) for Soviet submarines.”¹⁶

China must recognize that acoustic liabilities hampered Soviet SSBNs’ effectiveness, so there is reason to believe that it has worked to address these issues. A variety of evidence—including Chinese research on acoustics, sound isolation couplings, and advanced composite materials; development of a relatively advanced guide-vane propeller by the late 1990s; and employment of advanced seven-blade propellers with cruciform vortex dissipaters in both its indigenous *Song*-class and imported *Kilo*-class diesel-powered submarines—suggests that the *Jin* may have significantly improved propellers and other quieting technology.¹⁷

Google Earth photos reveal the *Jin* to be larger in diameter than the *Xia*, and larger submarines have historically been quieter because noise reducing efforts and machinery occupy more volume.¹⁸ Moreover, subsequent-generation submarines are generally significantly quieter than those of earlier generations, so it may be expected that China has made progress in quieting its submarines as well. Nevertheless, the *Jin* is still a second-generation SSBN, and those of other nations have faced significant acoustic difficulties. Indeed, despite Russian technology and assistance, China is unlikely to have yet fully exploited all possible technologies given the major challenges involved.

Training is another potential challenge for China’s emerging SSBN force. Although digital training and simulations can be useful, the only way other nations have become proficient at submarine operations is to take the boats to sea. Chinese exercises have increased in sophistication in recent years and currently encompass such categories as command and control, navigation, electronic countermeasures, and weapon testing.¹⁹

The PLAN has for some time pursued occasional nuclear-powered submarine missions of extended duration. In his memoirs, Admiral Liu Huaqing relates that he raised the priority of long-duration exercises for PLAN nuclear-powered attack submarines to test all parameters of new capabilities.²⁰ Apparently as part of these expanded activities, the author of a recent Chinese publication on the development of the PLAN’s nuclear-powered submarine force asserts that the current PLAN Assistant Chief of General Staff, two-star Admiral Sun Jianguo, com-

manded the nuclear-powered attack submarine *Han 403* during a mid-1980s mission of 90 days.²¹ Another Chinese source states that this mission broke an 84-day undersea endurance record previously held by the USS *Nautilus* (SSN-571).²²

Notwithstanding such reported achievements, and frequent shorter missions, Chinese submarine patrols have been relatively infrequent in most years—though the PLAN conducted 12 patrols in 2008, twice the number of patrols in 2007.²³ As *Jane’s Navy International* explains, “A patrol in this vernacular would seem to equate to a sustained seagoing deployment—lasting weeks at a time—to perform a specific task or mission, for instance: to ‘track and trail’ other submarines; participate in naval defense operations in coastal or extra-coastal areas; collect intelligence; or shadow surface units.”²⁴

This increase in patrols and the overall priority accorded to China’s submarine force development suggest that the PLAN’s submarines are now able to range farther afield on a more frequent basis. Indeed, the evolving missions and growing capabilities of the Chinese submarine force “create the conditions for Beijing

to opt for an increased submarine presence in the Western Pacific east of the Ryukyu Island chain.”²⁵

While the trajectory of training specifically relevant to deterrent patrols remains opaque, the PLAN is striving to improve the rigor and realism of education and training across the board. Within this context, submarines have clearly been an area of emphasis and the PLAN is using a variety of methods to prepare its sailors for future wars. Official Chinese publications note, for example, that various types of simulators have been used to improve submarine training.²⁶

Communications Hurdle

Establishing and maintaining secure and reliable communications with SSBNs constitutes a major challenge for any country that desires a sea-based deterrent. Chinese military publications emphasize that the central leadership must maintain strict, highly-centralized command and control of nuclear forces at all times and under all circumstances, a principle Beijing will undoubtedly seek to apply to its SSBNs as well as its land-based nuclear forces.²⁷

The Central Military Commission (CMC), the PRC’s highest-ranking military decision-making body, which is currently chaired by Hu Jintao, the President of China and general secretary of the Chinese Communist Party, exercises direct command and control over China’s strategic missile forces through the Second Artillery Corps. Presumably, the CMC would also exercise direct command and control over deployed SSBNs through the General Staff Department or

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PLAN headquarters. Indeed, China's 2002 *Defense White Paper* states that submarines capable of assuming the "strategic nuclear counterattack mission" are under the "direct command" of the CMC.²⁸ Moreover, according to authors John Wilson Lewis and Xue Litai, China's SSBN force, like all other nuclear units, is overseen and coordinated by the Strategic Forces Bureau, under the Operations Department of the General Staff Department. This is intended to ensure that "Only the [Central Military Commission] Chairman . . . has the authority to launch any nuclear weapons after getting the concurrence of the Politburo Standing Committee and the [Central Military Commission]."²⁹

China's submarine force has reportedly employed high-frequency (HF), low-frequency (LF), and very-low-frequency (VLF) communications.³⁰ Researchers are working on a number of technologies that could be useful for secure communications with submarines, as reflected by recent publications discussing the prevention of enemy detection of transmissions between submarines and shore-based headquarters units.

In addition, Chinese analysts have also shown interest in the practices of the U.S. Navy's highly survivable TACAMO (Take Charge and Move Out) air fleet, which uses a wide range of frequencies to receive, verify, and

retransmit emergency action messages between the U.S. national command authority and the nuclear triad.³¹ It remains unclear, however, to what extent centralized SSBN command, control, and communication is possible for China across the range of nuclear scenarios. This suggests another critical problem for the PLAN: ensuring the ability to communicate with SSBNs in an environment in which its command-and-control system has been degraded.

Beyond the problem of ensuring secure and reliable communications, the deployment of SSBNs also entails use-control challenges. Given the strong emphasis on centralized control of nuclear forces that is evident in official Chinese military and defense policy publications, it seems highly unlikely that the PLAN would conduct deterrent patrols without effective use controls. Presumably, China will strive not only to develop a communica-



LITTLE IS AVAILABLE Not much is known for certain about China's most recent SSBNs, the Type 094. This U.S. Navy illustration is 12-years old and highly speculative, but is one of the few officially released images of the class.

tions capability that is robust enough to ensure at least one-way wartime connectivity between Beijing and the *Jin*-class SSBNs, but also to minimize the possibility of an accidental or unauthorized launch by implementing some combination of technical and procedural controls.



HIDDEN FROM VIEW A satellite photograph shows the cave entrance at the newly-constructed submarine facility at Yalong Bay near Sanya on Hainan Island. The wide entrance is believed capable of accommodating the *Jin*-class SSBNs.

Notwithstanding the recent series of revelations about China's emerging SSBN force, a number of unanswered questions that have major implications for the future of China's sea-based deterrent remain. Three stand out as particularly important. First is the issue of how many SSBNs China will ultimately build, which will determine deterrence patrol tempos. Second, it remains unclear whether China will attempt to create bastions for its SSBNs in areas close to the mainland or deploy them to more distant patrol areas—a decision which will no doubt be informed in part by the capabilities of the JL-2 SLBM, which remains under development. Third, China is unlikely to reveal any information about its plans for coping with the command-and-control challenges associated with the deployment of a sea-based deterrent force, which could influence crisis stability and the security of China's retaliatory capability.

While these uncertainties remain, the investment already made in SSBN hulls and shore facilities indicates that the program represents a major effort to move beyond the ill-fated *Xia* and take China's deterrent to sea. In addition, the emergence of photos of at least two Type 094 submarines—and the apparent willingness to allow Western analysts to see them—appears to signal a new level of confidence on Beijing's part, and perhaps even a nascent recognition that modest increases in transparency could actually support China's strategic interests. Continued progress in this direction may be essential to avoiding a repeat of the Cold War at sea waged by the U.S. and Soviet navies in part to secure the undersea portion of their nuclear triads. ☀

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Despite recent revelations about China's emerging SSBN force, a number of unanswered questions that have major implications for the future of its sea-based deterrent remain.

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