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### China Maritime Report No. 28: Bitterness Ends, Sweetness Begins: Organizational Changes to the PLAN Submarine Force Since 2015

J. Michael Dahm

Alison Zhao

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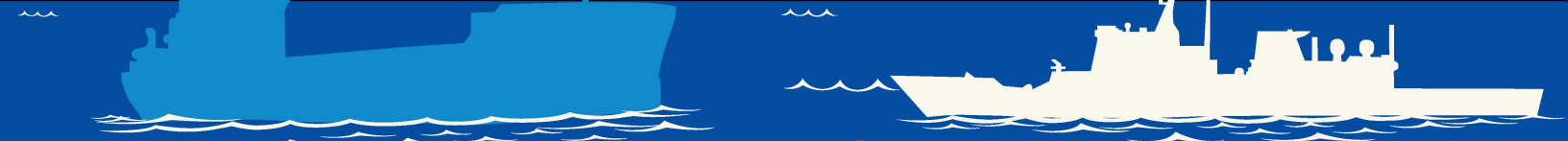
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中国海事研究所  
China Maritime Studies Institute



U.S. NAVAL WAR COLLEGE  
Est. 1884  
NEWPORT, RHODE ISLAND

## Summary

“Above-the-neck” reforms in the People’s Liberation Army (PLA) that began in 2015 directed the development of a new joint operational command system that resulted in commensurate changes to PLA Navy submarine force command and control. Additional changes to tactical submarine command and control were driven by the evolution and expansion of PLA Navy surface and airborne capabilities and the introduction of new longer-range submarine weapons. Follow-on “below-the-neck” reforms inspired significant organizational change across most of China’s military services. However, the PLA Navy submarine force, for its part, did not reorganize its command structure but instead focused on significant improvements to the composition and quality of its force. Between 2017 and 2023, the PLA Navy submarine force engaged in a notable transformation, shuffling personnel and crews among twenty-six submarines—eleven newly commissioned and fifteen since retired—relocating in-service submarines to ensure an equitable distribution of newer, more capable submarines across the fleet. Observations of infrastructure improvements at PLA Navy submarine bases portend even more changes to submarine force structure in the coming years.

## Introduction

Since the People’s Liberation Army (PLA) reforms began in 2015, the PLA Navy (PLAN) submarine force has likely endured one of the most tumultuous transformations in its history. “Bitterness ends, sweetness begins” (苦尽甘来) is a Chinese idiom that means the worst is over and better times lie ahead. While the reforms were probably difficult to swallow for the submarine force, they have almost certainly had a positive impact on PLAN undersea warfare capabilities.

The initial phase of PLA reforms—called the “above-the-neck” reforms for its focus on changes to top-level organizations—resulted in the creation of a joint operational command system. In the new system, geographic operational theaters took over control of ships and submarines from PLAN headquarters. The introduction of new technologies in the PLAN, including longer-range reconnaissance and surveillance and longer-range conventional and strategic weapons in the submarine force, drove further changes to submarine command and control.

While the first phase of reforms focused on the “head,” the subsequent phase of “below-the-neck” reforms, which began in 2017, resulted in changes to operational units, i.e., the “body” of the PLA. The PLA Army (PLAA) and Air Force (PLAAF) experienced profound organizational change—commands were combined or eliminated, and formations were fundamentally restructured. By contrast, the PLAN saw relatively few changes to its organizational structure, remaining very similar to its pre-reform state. But even if its command relationships were not reorganized in the reforms, changes to force structure and composition had significant impacts on the PLAN submarine force.

Key findings of this report include:

- “Above-the-neck” and “below-the-neck” reforms resulted in significant changes to the operational command and control of PLAN forces. Fleet organizational structure remained in place to serve the PLAN’s “man, train, and equip” functions.
- The “maritime operations sub-center” (MOSC) is the newly created PLAN-run maritime component of the theater joint operations command system in each PLA operational theater command. MOSCs now exercise command and control over most PLAN submarine deployments.
- Changes to tactical-level submarine command and control have been driven by new PLAN ships and aircraft in the fleet as well as new, longer-range weapons in the submarine force.

- The Central Military Commission’s (CMC) Joint Operations Command Center probably exercises exclusive control over ballistic missile submarines (SSBNs).
- Overseas submarine operations probably fall under the control of the CMC Joint Staff Department; however, operational theater commands have also demonstrated command and control of PLAN forces thousands of miles from China’s shores.
- “Below-the-neck” reforms in the PLAN submarine force did not result in changes to command organizational structure but did involve significant shifts in submarine fleet composition, and the attendant inter-fleet transfers of submarines and crews.
- Force structure changes were driven by the arrival of a dozen newly constructed submarines and the retirement of older nuclear and conventional submarines.
- Observed infrastructure improvements at PLAN nuclear submarine bases indicate that the PLAN will likely continue to incorporate new submarines over the next several years, probably extending the recent cycle of submarine and crew transfers.

This report comprises two sections and an appendix. Section one examines the first phase of PLA reform—the “above-the-neck” reforms—that began in 2015. This section discusses changes to joint operational command and control and its impact on PLAN submarine operations. It also goes into detail on PLAN task group organization, tactical command and control of submarines, and issues surrounding the control of strategic assets (e.g., SSBNs) and the command of foreign exercises and “far seas” operations. Section two examines the impacts of “below-the-neck” reforms and changes in submarine force structure. It also discusses the recently detected construction of submarine base infrastructure that likely portends further expansion of the PLAN submarine force. The report concludes with an appendix that offers details about PLAN submarine operational bases.

Table 1 lists NATO names for PLAN submarines, their respective Chinese designators, 2023 order-of-battle (OOB) numbers, and the change in order-of-battle since 2017. NATO names are used throughout this report, as are common naval acronyms for submarine types listed in the table.

Table 1. PLAN Submarine Types and 2023 Order-of-Battle.

NATO Name	PLAN Designator	2023 OOB	Change since 2017	NATO Name	PLAN Designator	2023 OOB	Change since 2017
<i>Jin</i> SSBN	Type 094, 094A	6	+2	<i>Xia</i> SSBN	Type 092	0	-1 <sup>a</sup>
<i>Shang</i> SSN	Type 093, 093A/B	6	+2 <sup>b</sup>	<i>Han</i> SSN	Type 091	0	-3 <sup>a</sup>
<i>Yuan</i> SSP	Type 039A/B/C/D	20	+7	<i>Kilo</i> SS	Type 636	10	-2
<i>Song</i> SS	Type 039, 039G	13	-	<i>Ming</i> SS	Type 035	3	-9
<i>Qing</i> SSA	Type 032	1	-				
Submarine Acronyms							
SSBN	Nuclear powered ballistic missile submarine			SS	Conventionally powered attack submarine (Diesel-electric powered attack submarine)		
SSN	Nuclear powered attack submarine						
SSP	Air-independent propulsion attack submarine			SSA	Auxiliary submarine (for test & evaluation)		

<sup>a</sup> 1 x *Xia* SSBN and 3 x *Han* SSN probably in caretaker status or decommissioned; awaiting scrapping.

<sup>b</sup> 2 x *Shang* SSN added 2017-2018. One additional *Shang* launched May 2022, with another launched early-2023 for total OOB of eight *Shang* once the new subs are commissioned, probably in 2024.

## Section 1. “Above-the-Neck” Reforms and Operational Command & Control (C2)

In late-2015, the PLA embarked on a series of historic reforms that reorganized operational and administrative chains of command and fundamentally restructured military commands and units across the PLA. As the moniker implies, these “above-the-neck” reforms focused on changes to the “head” of the PLA—the highest-level national and regional commands. The goals of the “above-the-neck” reforms were three-fold: 1.) separate operational responsibilities from force building responsibilities, 2.) shift from single service operations to joint operations, and 3.) shift from single service training to joint combat training.<sup>1</sup>

“Above-the-neck” and the subsequent “below-the-neck” reforms fundamentally oriented all PLA units toward integrated joint operations and joint C2. The PLA’s powerful General Staff Department was reorganized into new organizations under the Central Military Commission (CMC). The reforms created new service-level organizations like the PLA Rocket Force (PLARF) and Strategic Support Force (SSF). A newly formed CMC Joint Staff Department assumed responsibility for operational command and control. Military regions, which had been charged with defending the People’s Republic of China (PRC) from attack since the nation’s founding, were reorganized into five operational theaters.<sup>2</sup> Since the reforms, information has emerged about how service elements, including submarines and other undersea forces, have been subordinated within the PLA’s new “joint operational command system” (联合作战指挥体系).

Maritime component commands known as “theater maritime operations sub-centers” now exercise joint C2 of task forces that include submarines as well as forces involved in anti-submarine warfare, sea mining, and other undersea operations. The maritime operations sub-center is a PLAN-run component of the theater joint operations command system in each of the new geographic military theaters. C2 of strategic undersea forces such as SSBNs and out-of-area (i.e., “far seas”) undersea operations likely fall directly under the CMC’s national-level joint operations command center.

### *Joint Operational Command & Control*

In 2014, the PLA reportedly established an East China Sea Joint Operations Command Center (ECS JOCC) (东海联合作战指挥中心) to coordinate PLAN, PLAAF, and potentially China Coast Guard (CCG) operations in the East China Sea.<sup>3</sup> When information first emerged about the ECS JOCC, there was speculation in the international press that it had been established specifically to manage China’s ECS air defense identification zone (ADIZ), which was created in late-2013.<sup>4</sup> At the time, a China Ministry of Defense spokesman did not address the ADIZ speculation, merely commenting that the establishment of a joint operational command system was an inevitable requirement for joint

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<sup>1</sup> 刘金顺 [Liu Jinshun], 脖子以下改革要依令而行 [“Below-the-Neck Reforms Demand Following Orders and Performing”], 人民海军 [People’s Navy], 10 February 2017, p. 3.

<sup>2</sup> The PLA’s military region (MR) system ranged from six MRs in 1950 to as many as thirteen in the mid-1950s and eventually to the seven MRs that were replaced by the theater commands in 2015.

<sup>3</sup> Andrey Pinkov, 中國設立東海聯合作戰指揮中心 [“China Established the East China Sea Joint Command Center”], 漢和防務評論 [Kanwa Defence Review], 2014, p. 22, cited in Shinji Yamaguchi, “Chinese Intelligence, Surveillance, and Reconnaissance Operations in the Near Seas,” in *The PLA Beyond Borders*, ed. Joel Wuthnow, Arthur S. Ding, Phillip C. Saunders, Andrew Scobell, and Andrew N.D. Yang (Washington, DC: National Defense University Press, 2021), p. 139, <https://ndupress.ndu.edu/Publications/Books/PLA-Beyond-Borders/>.

<sup>4</sup> 白瑞雪 [Bai Ruixue] and 白洁 [Bai Jie], 国防部回应有关中国设立东海联合作战指挥中心报道 [“The Ministry of National Defense Responds to Reports on China’s Establishment of a Joint Operations Command Center in the East China Sea”], 人民网/新华网 [People’s Daily Online/Xinhua], 31 July 2014, <http://military.people.com.cn/n/2014/0731/c172467-25380091.html>.

operations. He went on to say that, in keeping with decisions made by the Third Plenary Session of the CCP's 18<sup>th</sup> Central Committee held in November 2013, the PLA would “embark on a path of joint operations command system reform with Chinese characteristics.”<sup>5</sup>

Since 2015, when “above-the-neck” organizational reforms were initiated, the PLA’s “joint operational command system” has replaced the largely ad hoc joint command and control arrangements that preceded it. Prior to the reforms, the CMC General Staff Department and military regions would form a unique joint campaign command organization (联合战役指挥机构) for a particular exercise or operation. When the military regions were organized into operational theaters in 2015, the CMC established a national-level joint operations command center (JOCC) (联合作战指挥中心) to oversee theater operations as well as national-level, strategic operations.

Reporting since 2015 indicates the CMC JOCC now supervises “theater joint operations command centers” (T-JOCC) (战区联合作战指挥中心) in each of the five military theaters.<sup>6</sup> By mid-2017, information began to emerge in official PLA media that T-JOCCs command different service and domain functions through “command sub-centers” (指挥分中心), later referred to as “operational sub-centers” (作战分中心).<sup>7</sup>

According to a 2017 *People's Navy* newspaper article about improvements in joint capabilities, an Eastern Theater Navy staff officer commented that the “fleet command post” (舰队指挥所) had been officially renamed the “theater maritime command sub-center” (战区海上指挥分中心).<sup>8</sup> It is unclear whether this new theater maritime command sub-center replaced the aforementioned ECS JOCC. It is possible that Eastern Theater air and maritime operations are now coordinated entirely through the new maritime sub-center. Alternatively, the sub-center may have retained the ECS JOCC as a subordinate command post specifically to coordinate ECS ADIZ operations or, possibly, operations in the vicinity of the Senkaku Islands.

Beyond the particularities of the Eastern Theater, the PLA appears to have established command centers and corresponding operational sub-centers in each of its five theaters.<sup>9</sup> These theater operational sub-centers align with the four major PLA services—the PLA Army, Navy, Air Force and Rocket Force—across their respective mission areas. These theater operations sub-centers are the “land operations sub-center” (LOSC) (陆上作战分中心), “maritime operations sub-center” (MOSC) (海上作战分中心), “air operations sub-center” (AOSC) (空中作战分中心), and “conventional

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<sup>5</sup> Ibid.

<sup>6</sup> Edmund J. Burke and Arthur Chan, “Coming to a (New) Theater Near You: Command, Control, and Forces,” in *Chairman Xi Remakes the PLA*, ed. Phillip C. Saunders, Arthur S. Ding, Andrew Scobell, Andrew N.D. Yang, and Joel Wuthnow (Washington, DC: National Defense University Press, 2019), p. 237.

<sup>7</sup> To be clear, “分” or “sub” indicates “subordinate” as in “分局” “sub-bureau.” It does *not* refer to “submarines.”

<sup>8</sup> 刘亚迅 [Liu Yaxun], 东海舰队适应新体制提升联合作战能力的启示 [“East Sea Fleet Enlightens the Adoption of New System to Improve Joint Operational Capabilities”], 人民海军 [*People's Navy*], 21 October 2017, p. 4, cited in Roderick Lee and Morgan Clemens, “Organizing to Fight in the Far Seas: The Chinese Navy in an Era of Military Reform,” *China Maritime Report No. 9*, China Maritime Studies Institute, October 2020, p. 6, <https://digital-commons.usnwc.edu/cmsi-maritime-reports/9/>.

<sup>9</sup> It is entirely possible, if not likely, that the Western Theater does not have a theater maritime operations sub-center.

missile operations sub-center” (CMOSC) (常导作战分中心).<sup>10</sup> The top-level theater command arrangement is depicted in Figure 1.

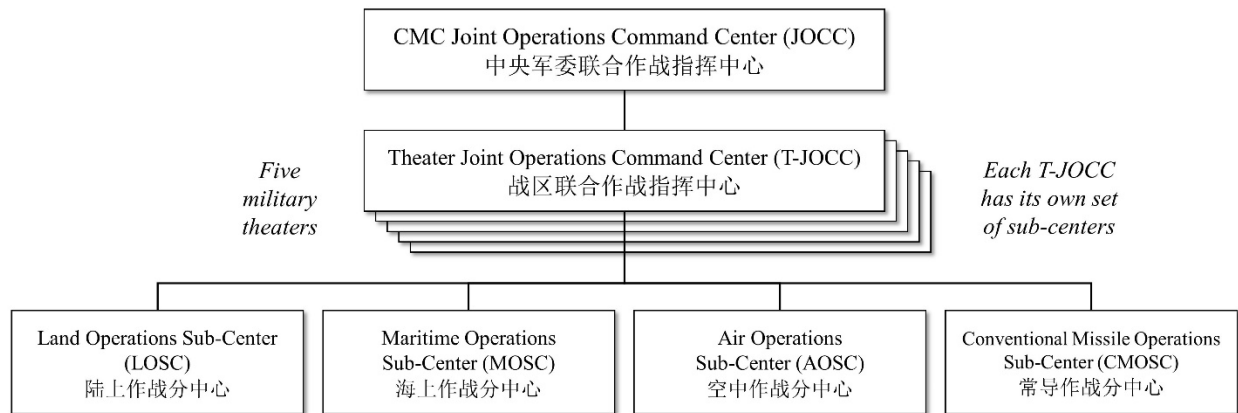


Figure 1. Top-Level Theater Joint Operations Command System

The new PLA joint operational command system appears to institutionalize and simplify the ad hoc campaign command system that preceded it. This new system also appears similar to joint command and control arrangements adopted by the United States military. The PLA’s MOSC and AOSC presumably perform functions similar to the U.S. Navy’s maritime operations centers (MOCs) and U.S. Air Force’s air operations centers (AOCs).<sup>11</sup>

In pre-reform, ad-hoc joint campaign command organizations, units were organized into subordinate operations groups (作战集团). Like the post-reform system identified above, these operations groups included land, maritime, air and missile operations groups. However, they also purportedly included a host of other functional groups such as information, special operations, joint landing, and space.<sup>12</sup> It is not entirely clear how the new, post-reform operations sub-center arrangement accommodates these other functions.

For example, the functions performed by the PLA’s Strategic Support Force (SSF) and Joint Logistics Support Force (JLSF) might be integrated in the command centers, sub-centers, and groups

<sup>10</sup> Terms for sub-centers appear in a number of credible references. See, for example, 荀焯 [Xun Ye], 李文源 [Li Wen Yuan], 武东东 [Wu Dongdong], and 竭咏松 [Ji Yong Song], 新体制下战区战时联勤组织指挥模式研究 [“Research on the Command of Theater Wartime Joint Logistics Organizations Under the New System”], 军事交通学院学报 [Journal of the Military Transportation University], 22, no. 11 (November 2020), p. 69, also 曾主东 [Zeng Zhudong], 实战实训, 锤炼新任干部 [“Practical Training Tempers New Cadres”], 人民海军 [People’s Navy], 22 October 2020, p. 3.

<sup>11</sup> In its pursuit of jointness, the U.S. military has created temporary joint task forces (JTFs) to conduct operations and exercises. Commanders aligned by mission area and domain include the joint force land component commander (JFLCC), joint force maritime component commander (JFMCC), and joint force air component commander (JFACC). Since the early 2000s, these temporary command arrangements have evolved into standing operations centers in U.S. military theaters. For the history of U.S. Navy MOCs, see, William Lawler and Jonathan Will, “Moving Forward: Evolution of the Maritime Operations Center,” Center for International Maritime Security, 19 October 2016, <https://cimsec.org/moving-forward-evolution-maritime-operations-center/>. Currently, U.S. military theaters do not have standing land operations centers (LOCs). The U.S. Army instead appears to simply refer to joint and combined land component commander headquarters. See, U.S. Joint Chiefs of Staff, *Joint Land Operations*, JP 3-31 (Washington, DC: U.S. Department of Defense, October 3, 2019, Incorporating Change 1, November 16, 2021), I-6.

<sup>12</sup> Jeffery Engstrom, *Systems Confrontation and Systems Destruction Warfare*, RR-1708-OSD (Santa Monica, CA: RAND, 2018), pp. 33-36, [https://www.rand.org/pubs/research\\_reports/RR1708.html](https://www.rand.org/pubs/research_reports/RR1708.html).

throughout the theater command system.<sup>13</sup> Like logistics forces focused on sustainment, the SSF may act in a support role for operational forces by providing intelligence and communications. However, SSF units can also deliver offensive effects using cyber, electronic warfare, and counterspace capabilities.

Relative to undersea warfare, underwater acoustics and “hydroacoustic confrontation” (水声对抗) is categorized by the PLA as an area of electronic warfare.<sup>14</sup> While operations in the undersea domain are decidedly within the purview of the PLAN, the SSF, which has overarching responsibility for electronic warfare and electronic intelligence in the PLA, very likely plays a role in hydroacoustic and underwater reconnaissance.<sup>15</sup> Some Chinese military authors have indicated there is, or perhaps should be, an information operations or network-electronic warfare operations sub-center.<sup>16</sup> There are currently no outward indications that an information operations sub-center has been established in the theaters. A theater information operations sub-center would presumably exercise control of theater information operations groups and formations which have been noted in recent PLA parades.<sup>17</sup> The SSF may also have a role in national level hydroacoustic collection and processing of acoustic information from, for example, current or future underwater arrays, presumably fusing such intelligence with other sources such as signals intelligence.

Researchers at the PLA’s National University of Defense Technology (NUDT) (国防科技大学) have offered additional details about subordinate organizations within the theater joint operational command system. In a 2021 English-language paper, NUDT researchers modeled the communications networks from a “real war game” between Red (friendly) and Blue (enemy) forces. The Red command and control arrangements were provided in a diagram to illustrate the network nodes that were modeled. The diagram shows the T-JOCC and sub-centers and two levels of subordinate operational groups, task forces, and formations (see Figure 2 below).<sup>18</sup> The war game C2

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<sup>13</sup> Xun, Li, Wu, and Ji, “Research on the Command of Theater Wartime Joint Logistics Organizations Under the New System,” pp. 68-72.

<sup>14</sup> See, for example, *Lectures on Joint Campaign Information Operations*, ed. Yuan Wenxian (Beijing: National Defense University Press, 2009), p. 34, trans. China Aerospace Studies Institute (Montgomery, AL: Air University, 2021), p. 29, <https://www.airuniversity.af.edu/CASI/Display/Article/2793721/in-their-own-words-lectures-on-joint-campaign-information-operations/>.

<sup>15</sup> The SSF’s Information Engineering University offers degrees in specialties that includes “hydroacoustic engineering” (水声工程) focused on “underwater reconnaissance detection” (水下侦察探测), Kenneth Allen and Mingzhi Chen, *The People’s Liberation Army’s 37 Academic Institutions*, (Montgomery, AL: Air University, 2020), p. 224, <https://www.airuniversity.af.edu/CASI/Display/Article/2216778/the-peoples-liberation-armys-academic-institutions/>.

<sup>16</sup> 王劲松 [Wang Jinsong], 王南星 [Wang Nanxing], and 哈军贤 [Ha Junxian], 网络空间作战指挥体系研究 [“Research on Cyberspace Operations Command System”], 装甲兵工程学院学报 [*Journal of the Academy of Armored Force Engineering*], no. 5 (2016), pp. 1-4, 19, cited in Elsa Kania and John Costello, “The Strategic Support Force and the Future of Chinese Information Operations,” *The Cyber Defense Review*, 31 July 2018, p. 113, <https://cyberdefensereview.army.mil/CDR-Content/Articles/Article-View/Article/1589125/the-strategic-support-force-and-the-future-of-chinese-information-operations/>.

<sup>17</sup> A 2017 PLA parade seemed to indicate the existence of down-echelon information operations groups that consist of formations such as an information support formation, electronic reconnaissance formation, electronic countermeasure formation, and unmanned aerial vehicles (UAV) formation. See Kania and Costello, “The Strategic Support Force and the Future of Chinese Information Operations,” p. 114.

<sup>18</sup> Tongliang Lu, Kai Chen, Yan Zhang and Qiling Deng, “Research on Dynamic Evolution Model and Method of Communication Network Based on Real War Game,” *Entropy* 23, no. 487 (April 2021), pp. 1-18, <https://www.mdpi.com/1099-4300/23/4/487#>.



diagram appears to suffer from some minor inconsistencies and peculiarities that are probably a bi-product of Chinese-to-English machine translation.

Based on the forces involved, the subject war game likely simulated the first wave of an amphibious landing operation with significant air and maritime strikes in support. The diagram was intended to show the relationship between air and maritime elements; therefore, details of landing force subordinate units were not provided. Despite the fact that the English-language labels vary slightly, the land, air, maritime, and conventional missile operations sub-centers are shown under the theater joint operations center, consistent with other sources that outline the PLA's joint operational command system.

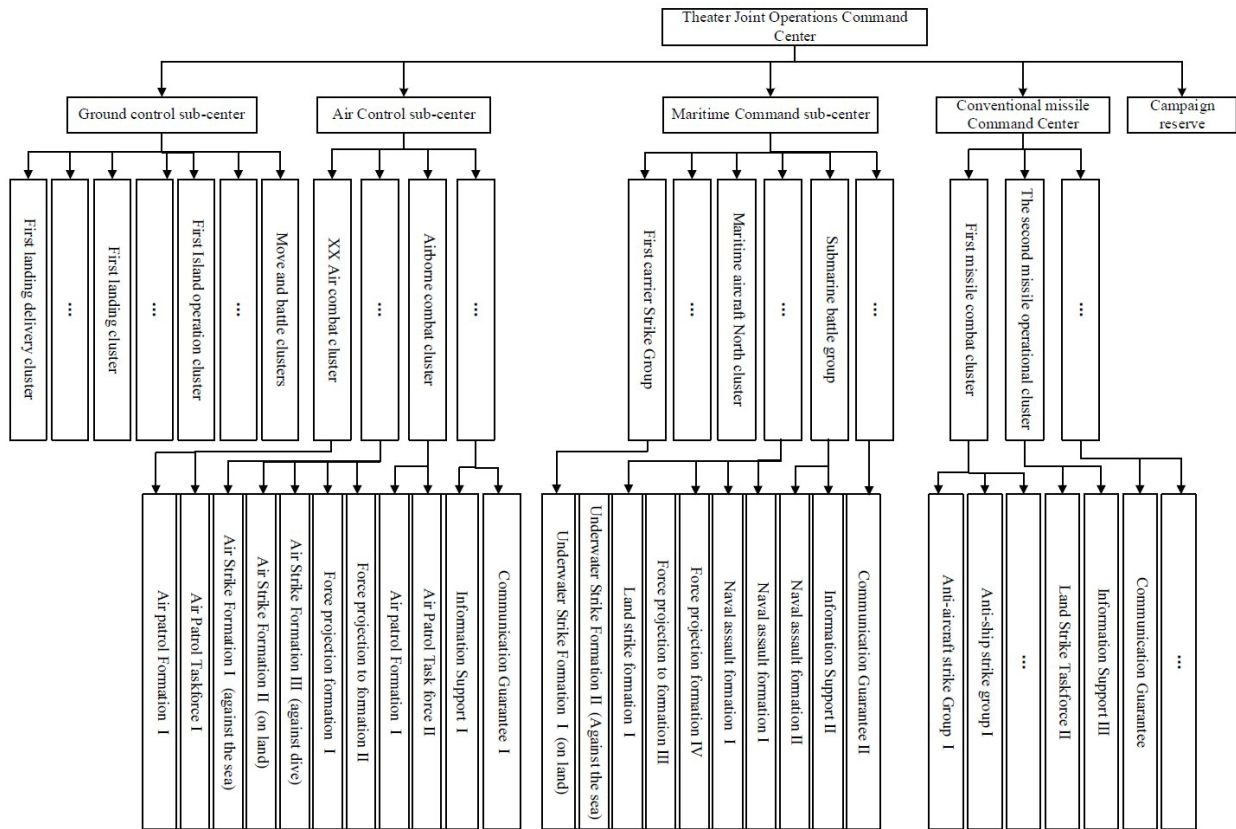


Figure 2. Diagram of Chinese Military War Game Command and Control Nodes<sup>19</sup>

### “Jointness” and Multi-Domain C2 Challenges

While it should be acknowledged that the war game article is only one point of reference, what may be inferred from the C2 diagram is that surface and undersea forces will likely be under the control of the MOSC. Such a C2 relationship facilitates airspace and waterspace management, provides for self-defense of maritime forces, and prevents fratricide in the maritime environment.

<sup>19</sup> Ibid.

According to prevailing Chinese military theory, “multi-domain integrated joint operations” is the PLA’s current goal for its forces.<sup>20</sup> However, such integration and cross-domain C2 is a challenge even for Western militaries that have been pursuing the goal much longer than the PLA. The PLA’s vision of multi-domain integrated joint operations will likely remain aspirational through the mid-2020s. The goal of PLA “jointness” might be realized in the near term through cross-service tasking.

The war game diagram has one “land strike formation” that falls under the MOSC, while another falls under the command of the CMOSC. This suggests that land strikes, at least for this war game, may have been controlled and coordinated at the T-JOCC which then probably tasked the sub-centers. Alternatively, a sub-center like the CMOSC might have had responsibility for all land strike C2. In that case, the CMOSC would provide strike tasking to the maritime and air sub-centers, or possibly transmit orders skip-echelon directly to the non-CMOSC land strike formations. In another joint-tasking scenario, ground forces in something like the “first landing cluster” might be able to directly task a land strike formation with calls for fire support.

In the near term, command relationships between the AOSC and MOSC in their control of air assets, surface forces, and undersea forces offer the greatest potential to realize the PLA’s vision of multi-domain joint C2 involving undersea forces. The original 2017 *People’s Navy* newspaper reference to the “theater maritime command sub-center” cited earlier in this section quotes the PLAN staff officer:

In the past, the fleet command post could only mobilize aircraft belonging to the fleet to support and cover submarines. Now, as the theater maritime command sub-center, it can command and coordinate (指挥协调) theater naval and air force aircraft to implement joint support and cover. This requires us to have a good understanding of the performance and use of Air Force aircraft.<sup>21</sup>

One interpretation of this submarine air support example might have the theater AOSC controlling theater air operations while the MOSC has the capability to control specific air assets in direct support of a submarine. Expounding on this example, the theater MOSC might assume control of a PLAAF combat air patrol (CAP) and position it to keep enemy maritime patrol aircraft away from a PLAN submarine operating area. “Command and coordinate” might also imply that the MOSC coordinates or orchestrates air support. The MOSC may simply have a priority to request support or the authority to direct the AOSC to provide PLAAF CAP support. Actual PLAN control of PLAAF aircraft in support of submarine operations would likely depend on the presence of surface ship air controllers or a PLAN airborne early warning and control (AEW&C) aircraft near the submarine operating area where the CAP is required.

C2 relationships between the theater air and maritime operations centers are necessarily complicated by PLAN surface-to-air missiles and the potential for fratricide. Over land, the PLAAF and its theater AOSC control both aircraft and long-range surface-to-air missiles.<sup>22</sup> In the maritime domain,

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<sup>20</sup> 肖天亮 [Xiao Tianliang], ed., *战略学 [Science of Military Strategy]* (Beijing: National Defense University Press, 2020), p. 80.

<sup>21</sup> Liu, “East Sea Fleet Enlightens the Adoption of New System to Improve Joint Operational Capabilities,” p. 6.

<sup>22</sup> 文婧 [Wen Jing], 文秘 [Wen Me], 朱奕杰 [Zhu Yijie], 方强 [Fang Qiang], and 张扬 [Zhang Yang], 基于超网络的空战场管制体系建模及评估 [“Modeling and Evaluation of Air Battlefield Control System Based on Super-Network”], *火力与指挥控制 [Fire Control & Command Control]*, 46, no. 3 (March 2021), p. 9. PLA Army unit air defenses are typically restricted to self-defense and engagements at lower altitudes to deconflict with PLAAF operations.

however, PLAN surface ships operate their own surface-to-air missiles for air-defense and airspace denial. Moreover, the PLAN operates its own shore-based surface-to-air missiles to defend PLAN bases and naval concentration areas.<sup>23</sup>

A logical C2 arrangement would have a PLAN task force and, by association, the theater MOSC controlling all PLAN and PLAAF aircraft in a given maritime operations area that involves surface ships or shore-based naval defenses. The theater AOSC, MOSC, and CMOSC may need to deconflict space and time for aircraft or missiles to pass through or operate near a PLAN task force or maritime operations area. That would include, of course, anti-ship or land-attack submarine launched missiles that may pass through another sub-center's area of responsibility.

PLAN submarines and other undersea platforms will benefit significantly from joint C2 that affords protection from the threat of enemy ASW helicopters, maritime patrol aircraft, and surface ships. As PLAN submarines operate farther from the Chinese mainland and employ longer-range anti-ship and land-attack missiles, it remains to be seen whether the PLA will be able to realize the synergies between ground, maritime, air, and missile forces that real-time joint C2 promises.

#### *PLAN Task Group Organization*

As with changes to theater-joint C2, changes to tactical-level submarine C2 were accommodated by PLAN command structures that existed prior to the roll-out of “above” and “below-the-neck” reforms. Modifications to tactical-level submarine C2 were inspired by the addition of new naval platforms and aircraft in the PLAN as well as new weapons in the submarine force. Notably, since 2017 a submarine launched version of the long-range YJ-18 anti-ship cruise missile has entered service with *Song*, *Yuan*, and *Shang* attack submarines.<sup>24</sup> This created operational requirements for PLAN submarines to receive real-time target information hundreds of nautical miles over-the-horizon.

In addition to newer, more capable weapons and submarines entering the PLAN, new surface ships and aircraft have enabled joint C2 as well as at-sea and airborne command of air, surface, and subsurface elements. Since 2018, two PLAN aircraft carriers have become operational, providing advanced C2 capabilities, communications, and accommodations for at-sea command posts.<sup>25</sup> Similarly, new *Renhai* (Type 055) cruisers entered the PLAN fleet beginning in 2020. While probably optimized for C2 of PLAN air defense, the *Renhai* cruisers have the communications capabilities and staff accommodations to command relatively large PLAN task forces that may include submarines.<sup>26</sup> A significant increase in PLAN land-based special mission aircraft has also enabled maritime reconnaissance and C2 over broad areas of water space. The production of PLAN

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<sup>23</sup> For an example of PLAN base air defense in the South China Sea, see J. Michael Dahm, *South China Sea Military Capability Series: Offensive and Defensive Strike* (Laurel, MD: JHU Applied Physics Laboratory, 2021), pp. 4-7, <https://www.jhuapl.edu/sites/default/files/2022-12/OffensiveDefensiveStrike.pdf>.

<sup>24</sup> Office of the U.S. Secretary of Defense, *Military and Security Developments Involving the People's Republic of China (CMPR)* (Washington, DC: Department of Defense, 2022), pp. 53-54, <https://www.defense.gov/CMPR/>.

<sup>25</sup> The PLA announced that its *Liaoning* (Type 001) aircraft carrier achieved initial operational capability in mid-2018. See “China Military: Aircraft Carrier Liaoning Formed System Combat Capability,” *China Global Television Network (CTGN)*, 31 May 2018, [https://news.cgtn.com/news/3067444d32454464776c6d636a4e6e62684a4856/share\\_p.html](https://news.cgtn.com/news/3067444d32454464776c6d636a4e6e62684a4856/share_p.html). The Type 002 carrier *Shandong* entered service with the PLAN in 2019.

<sup>26</sup> Daniel Caldwell, Joseph Freda, and Lyle J. Goldstein, “China’s Dreadnought? The PLA Navy’s Type 055 Cruiser and Its Implications for the Future Maritime Security Environment,” *China Maritime Report No. 5*, China Maritime Studies Institute, p. 19, <https://digital-commons.usnwc.edu/cmsi-maritime-reports/5>.

anti-submarine warfare (ASW)/maritime patrol (MARPAT) aircraft such as the KQ-200 and AEW&C aircraft such as the KJ-500 surged in 2019, a trend that likely continued through 2022.<sup>27</sup>

Again, it should be acknowledged that the war game diagram provided by PLA researchers and introduced in the last section of this report is probably not a “Rosetta stone” for deciphering PLA C2 relationships. Still, the diagram offers indications of probable PLAN operational C2 and associated terminology. An excerpt from the war game C2 diagram appears in Figure 3. (Relative “tiers” are provided as a reference here, but do not appear in the PLA research paper.)

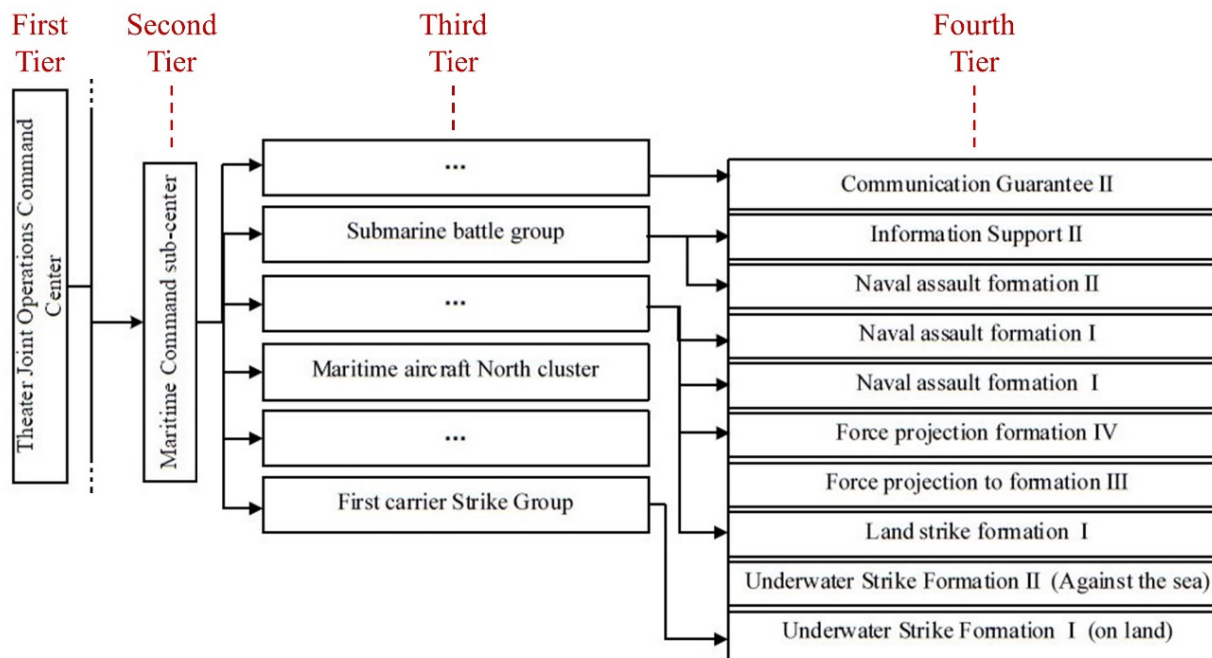


Figure 3. Maritime Command Excerpt from China Military War Game Diagram<sup>28</sup>

Beneath the T-JOCC and the operational/command sub-centers, most of the third-tier organizations are referred to as landing, battle, combat, or operational “clusters.” “Cluster” is probably “集群” or “群,” terms used by the PLA to describe temporary groupings for mission tasks.<sup>29</sup> Beneath the maritime operations sub-center, there is a submarine “battle group” (probably 战斗群) and a carrier strike group (possibly 航母战斗群 or 航母战斗打击群). The “first” in the “First carrier Strike Group” [sic] may simply be the ordinal number of carrier strike groups in the war game. Alternatively, this may refer to the PLAN’s actual 1<sup>st</sup> Carrier Task Group.<sup>30</sup> In any case, this “group”

<sup>27</sup> Liu Xuanzun, “China Mass-Produces Special Mission Aircraft,” *Global Times*, 8 December 2019, <https://www.globaltimes.cn/content/1172715.shtml>, and volume of special mission aircraft in production as of 2022 per commercial satellite imagery, Airbus, Pleiades, Image ID: DS\_PHR1A\_202201150339459\_FR1\_PX, 15 January 2022, AVIC Shaanxi Aircraft Corporation Plant, China, 33.137N, 107.199E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com).

<sup>28</sup> Lu, Chen, Zhang and Deng, “Research on Dynamic Evolution Model and Method of Communication Network Based on Real War Game,” p. 17.

<sup>29</sup> *Pleco/Military Mandarin*, s.v. “群,” accessed 12 March 2023.

<sup>30</sup> The PLAN’s 1<sup>st</sup> Carrier Task Group (91181 部队) was created in 2011 and is associated with the *Liaoning* CV. The 2<sup>nd</sup> Carrier Task Force (91910 部队), created in 2017 is associated with the *Shandong* CV. See Lee and Clemens, “Organizing to Fight in the Far Seas,” p. 3.

probably refers to a command element—a “formation command post” (编队指挥所) subordinate to the MOSC.

The 1<sup>st</sup> Carrier Task Group is a command associated with the PLAN aircraft carrier *Liaoning* and is probably functionally equivalent to a U.S. Navy carrier strike group that commands an aircraft carrier as well as other ships and submarines in the strike group formation. The official name of the 1<sup>st</sup> Carrier Task Group is likely “航空母舰第一编队指挥所” which probably translates to “Aircraft Carrier 1<sup>st</sup> Task Group Command Post.” Figure 4 shows what are likely the *Liaoning* command crest and the 1<sup>st</sup> Carrier Task Group crest. While one probably should not read too much into “logo-derived intelligence,” a silhouette of a submarine appears in the center of the crest along with a surface combatant, carrier, and fighter aircraft indicating that the command post is probably responsible for controlling a full complement of PLAN forces within the task group. This same command post has probably been referred to in Chinese media reporting as the “*Liaoning* Task Group Command Post” (辽宁舰编队指挥所).<sup>31</sup> The 1<sup>st</sup> Carrier Task Group was apparently the PLAN’s first permanent task force command post.<sup>32</sup>



Figure 4. Command Crests of *Liaoning* CV (left) and 1<sup>st</sup> Aircraft Carrier Task Group Command Post (right)<sup>33</sup>

<sup>31</sup> 徐隽 [Xu Jun] and 刘博通 [Liu Botong], 辽宁舰, 入列满十年 [“*Liaoning*, Enlisted for Ten Years”], 人民日报 [People’s Daily], 27 September 2022, p. 8, [http://paper.people.com.cn/rmrb/html/2022-09/27/nw.D110000renmrb\\_20220927\\_1-08.htm](http://paper.people.com.cn/rmrb/html/2022-09/27/nw.D110000renmrb_20220927_1-08.htm).

<sup>32</sup> Lee and Clemens, “Organizing to Fight in the Far Seas,” p. 3.

<sup>33</sup> 中国海军航母第一编队指挥所标志亮相 [“The Logo of the Chinese Navy Aircraft Carrier First Task Force Command Post”], 新浪图片 [Sina Pictures], 9 December 2013, [http://slide.mil.news.sina.com.cn/slide\\_8\\_33676\\_27126.html](http://slide.mil.news.sina.com.cn/slide_8_33676_27126.html). The crests were purportedly photographed at the 2013 Shanghai International Maritime Exhibition. The command post crest reads: “China People’s Liberation Army Navy Aircraft Carrier First Task Group Command Post” (中国人民解放军海军

According to PLA media reports, virtually any PLAN ship can assume the role of a formation or task force command post. Such at-sea command posts may control formations ranging from three-ship counterpiracy formations to the combined fleet in a 2021 China-Russia maritime exercise.<sup>34</sup>

PLA media reporting tacitly confirms that task forces command and control submarines. A 2022 article on the *Liaoning* aircraft carrier mentions “a certain center of the Liaoning Task Group Command Post” connecting “submarines, ships, and fighters across hundreds of nautical miles into a network to win the battle beyond line-of-sight.”<sup>35</sup> It is entirely possible that the “certain center” mentioned in the quote is either the command post operations center or communications center. Historically, PLA units engaged in operational campaigns set up a command post system (指挥所体系) to conduct operations. A PLA command post would have several centers, such as an operations center (作战中心), intelligence center (情报中心), communications center (通信中心), sustainment center (保障中心), integrated fires coordination center (综合火力协调中心), and information operations center (信息作战中心).<sup>36</sup>

What can be inferred from these observations about maritime command posts in conjunction with the war game diagram is that the MOSC probably directly controls several task-organized clusters or formations of aircraft, ships, and submarines. Additionally, the MOSC may employ intermediary command posts—“battle groups” or “strike groups”—to control task-organized formations. The at-sea or shore-based command posts and their functional centers equate to an operational naval staff, probably several dozen personnel for at-sea command posts. The command post staff would likely embark on a ship with the communications facilities and requisite command space onboard, likely an aircraft carrier, cruiser, or large-deck amphibious ship.

Fourth-tier organizations below the “clusters” and “groups” are classified as “formations,” (probably also “编队”). Typically, in the case of PLAN surface ships or submarines, a formation simply consists of two or more vessels. In the context of this C2 arrangement, a “formation” might also refer to a single task-assigned vessel. These formations, like “clusters,” are temporary operational groupings created to accomplish missions or perform specific functions in an operation. Therefore, the “naval assault formations” in the diagram may be formations with an anti-surface mission. The “force projection formations” are probably ships in an amphibious landing task force. For undersea warfare purposes, force projection formations might also include submarines conducting offensive or defensive mining. The “land strike formations” are possibly ships conducting strikes with land-attack cruise missiles or naval gunfire support. The “underwater strike formations” may be anti-submarine warfare (ASW) elements. If so, “on land” may refer to land based ASW/MARPAT aircraft and “against the sea” may refer to surface ASW or ASW helicopters launched from surface ships.

Due to the practical limitations of undersea operations and submarine communications, it is very unlikely that the “submarine battle group” on the wargame diagram is a command post embarked on a submarine. Instead, a submarine battle group command post would probably be embarked on a

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航空母舰第一编队指挥所)。“编队” is more commonly translated as “formation,” but PRC English-language sources will often translate “编队” as “task group” or “task force” as in “counterpiracy task force.”

<sup>34</sup> The *Renhai*-class CG *Nanchang* acted as command post for the 2021 China-Russia joint maritime exercise. 韩成 [Han Cheng] and 孙飞 [Sun Fei], 立体布网 深海“猎鲨,” [“Three Dimensional Networks, Deep Sea ‘Shark Hunting.’”], 解放军报 [PLA Daily], 18 October 2021, [http://www.81.cn/jfjbmap/content/1/2021-10/18/04/2021101804\\_pdf.pdf](http://www.81.cn/jfjbmap/content/1/2021-10/18/04/2021101804_pdf.pdf).

<sup>35</sup> Xu and Liu, “*Liaoning*, Enlisted for Ten Years,” p. 8.

<sup>36</sup> *Pleco/Military Mandarin*, s.v. “指挥所体系” [command post system], accessed March 27, 2023.

large ship or, more likely, a shore station with direct access to very-low frequency (VLF) transmitters for broadcasting orders to submarines underwater. The “submarine battle group” command post may control several submarines. In the case of the wargame, this appeared to include submarines for “information support,” which may be submarines acquiring and transmitting information on enemy targets, and a “naval assault formation” of submarines conducting an anti-surface warfare (ASW) mission. Based on a combination of wargame analysis and supposition, the notional operational C2 structure for PLAN undersea forces using clarifying terminology is shown in Figure 5. A future submarine-uncrewed underwater vehicle (UUV) teaming formation is included for illustration but is purely speculative. Future submarine ASW formations, both offensive and defensive, will also likely be featured when PLAN submarine ASW capabilities improve.

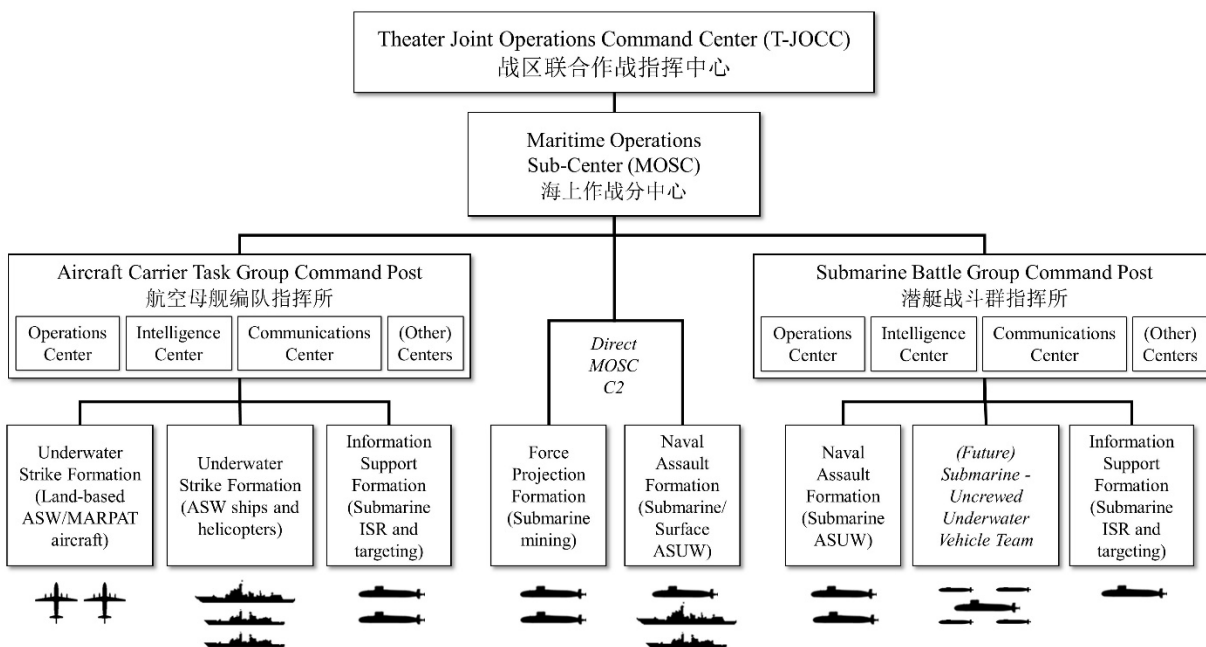


Figure 5. Assessed PLAN Undersea Forces C2 Structure using Notional Formations

### *Tactical Command and Control of Submarines*

Virtually no information on PLAN submarine integration with carrier task groups or other surface formations has emerged from official PLA media, military authors, or other publicly available sources. Submarines are sometimes referred to as “mission boats” (任务艇) in PLA media. However, such reporting on mission boat operations and exercises tends to portray the submarine as an independent actor rather than part of a larger naval formation. Assuming that submarines are, in fact, integrated with task group/formation C2, some general observations may be made based on select task group deployments and the practical requirements of operating submarines in conjunction with other maritime forces.

To the earlier observation that the 1<sup>st</sup> Carrier Task Group was the PLAN’s first permanent task force command post, it is important to note that while this organization may have been the first standing at-sea command post, there are no indications that the ships and presumably the submarines that operate with this task group command post are set. In fact, observations of three *Liaoning* CV training evolutions in the Philippine Sea (2021-2022) reveal a rotation of surface combatants accompanying the aircraft carrier. Japanese Maritime Self-Defense Force reporting on PLAN activity beyond the First Island Chain reveals that the only two ships common to the deployments were the aircraft

carrier and its accompanying oiler. One cruiser and one destroyer were common to two deployments (see Table 2 below).

Table 2. Carrier Strike Group Out-of-Area Deployments 2021-2022<sup>37</sup>

December 2021		May 2022		December 2022	
Ship Class/Type	Hull	Ship Class/Type	Hull	Ship Type	Hull
<i>Liaoning</i> CV (Type 001)	16	<i>Liaoning</i> CV	16	<i>Liaoning</i> CV	16
<i>Renhai</i> CG (Type 055)	101	<i>Renhai</i> CG	101	<i>Renhai</i> CG	103
<i>Luyang III</i> DDG (Type 052D)	154	<i>Luyang III</i> DDG	117	<i>Renhai</i> CG	104
<i>Jiangkai II</i> FFG (Type 054A)	598	<i>Luyang III</i> DDG	120	<i>Luyang III</i> DDG	120
		<i>Luyang III</i> DDG	118	<i>Jiangkai II</i> FFG	542
		<i>Luyang II</i> DDG (Type 052C)	151		
		<i>Jiangkai II</i> FFG	531		
<i>Fuyu</i> AOE (Type 901)	901	<i>Fuyu</i> AOE	901	<i>Fuyu</i> AOE	901

Based on the surface combatant composition of the task groups, if one or two submarines were integrated with the *Liaoning* Task Group, it is probable that submarines would also rotate through the task group line up. With the exception of *Luyang III* DDG 154 and *Jiangkai II* FFG 531, both believed to be Eastern Theater Navy ships, all of the other *Liaoning* Task Group ships are from the Northern Theater Navy.<sup>38</sup> Therefore, it is probable that any submarines accompanying the task group on its excursions to the Philippine Sea also came from the Northern Theater Navy.

Changes to submarine C2 relationships are, again, driven by significant improvements in PLAN capabilities and the introduction of new platforms and technologies. Also, the maritime space is becoming increasingly crowded with PLAN ships, submarines, and aircraft, especially in the confines of China’s “near seas”—the Yellow Sea, East China Sea, and South China Sea. Previously, a PLAN submarine may have been left to its own devices to trail a foreign surface force or aircraft carrier. Today, the need for integrated C2 of submarines and other PLAN forces is a critical component of waterspace deconfliction. As PLAN surface and airborne ASW improves and operates in new, unfamiliar areas, integrated C2 of submarines will prevent “red-on-red” actions. Integrated C2 will also enable coordinated offensive actions with new submarine attack capabilities.

#### *Targeting Support for Long-Range Submarine-Launched Weapons*

As demonstrated in other sections of this report, changes in C2 arrangements for targeting support are driven by a requirement to accommodate new technologies and new capabilities. Assessed changes to submarine C2 arrangements have probably been led by the availability of newer, larger, more capable command and control platforms, the advent of new communications technologies, an increasingly diverse network of more capable submarines, aircraft, and surface ships, and the acquisition of longer-range submarine-launched weapons.

<sup>37</sup> PLAN ship deployment information from Japanese Joint Staff, “Movement of Chinese Navy Fleet” (“中国海軍艦艇の動向について”) press releases, 17-21 December 2021, 2-22 May 2022, and 16-28 December 2022, [www.mod.go.jp/js/press/index.html](http://www.mod.go.jp/js/press/index.html).

<sup>38</sup> Fleet assignments are based on best available open-source information, but current disposition could not be verified. “Renhai (Type 055) class (CGHM)” (updated January 19, 2023), “Luyang III (Type 052D) class (DDGHM)” (updated August 8, 2022) and “Jiangkai II (Type 054A) class (FFGHM)” (updated 19 January 2023), *Janes Fighting Ships* (updated 26 January 2023), accessed 23 March 2023, [www.janes.com](http://www.janes.com).



Images of a submarine-launched version of the long-range YJ-18 anti-ship cruise missile (ASCM) first emerged in 2017.<sup>39</sup> A 2018 video of Xi Jinping touring a Northern Theater Navy *Shang*-class SSN appears to show what military enthusiasts have claimed is a YJ-18 missile canister in the submarines torpedo room, indicating the ASCM may have been in service with the PLAN submarine at the time.<sup>40</sup> After launch from a submarine's torpedo tube, the YJ-18 flies a sea-skimming profile at sub-sonic speeds (~0.8 Mach) at ranges up to 290 nautical miles (537 kilometers) and then accelerates to supersonic speeds (3.0 Mach) as it approaches its target.<sup>41</sup> The range of the YJ-18 effectively tripled the distance at which Chinese submarines could engage targets.<sup>42</sup> The advent of the YJ-18 in the PLAN's attack submarine force accentuated the need for enhanced C2 for long-range over-the-horizon targeting and coordinated strikes with PLAN aircraft, surface combatants, and other submarines.

In 2021, two researchers at China's Navy Submarine Academy sought to address the impact of different submarine communications methods and C2 processes on long-range missile targeting and the mathematical probability of missiles finding their targets at different ranges. The authors provided an illustration of a generic submarine over-the-horizon attack process relying on what they identified as the "four main communications channels" for a submarine: very-low frequency (VLF) communications, high-frequency (HF) communications, satellite communications (SATCOM), and ultra-high frequency (UHF) communications. Figure 6 is a translation of the illustration.<sup>43</sup>

The PLAN authors postulate a decision process in which a platform such as a satellite, aircraft, or ship detects a surface target and passes that information to a shore or at-sea command post. The command post then passes processed target information and strike orders directly to the submarine by either VLF, HF, or satellite communications. Alternatively, the command post passes the information to "coordinating forces." These are described as aircraft or ships within line-of-sight of the submarine that may pass targeting information via UHF datalink.<sup>44</sup>

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<sup>39</sup> "Submarine-Launched Variant of China's YJ-18 Supersonic Anti-Ship Missile Emerges," *Navy Recognition*, 2 October 2017, <https://www.navyrecognition.com/index.php/naval-news/naval-news-archive/2017/october-2017-navy-naval-forces-defense-industry-technology-maritime-security-global-news/5620-submarine-launched-variant-of-china-s-yj-18-supersonic-anti-ship-missile-emerges.html>.

<sup>40</sup> "Xi Encourages China's Navy Soldiers to Commit to Training," *China Global Television Network (CGTN)*, 15 June 2018, <https://www.youtube.com/watch?v=3F0kXbPR65w>.

<sup>41</sup> "YJ-18 (Yong Ji-18)," (updated November 18, 2022), *Janes Weapons: Naval* (updated 18 November 2022), accessed 23 March 2023, [www.janes.com](http://www.janes.com).

<sup>42</sup> The YJ-18's predecessor was likely a submarine-launched variant of the YJ-82 or C-802 ASCM, which the U.S. Department of Defense credits with a 97 NM (180 km) range. Office of the U.S. Secretary of Defense, *CMPR*, p. 54.

<sup>43</sup> 王德一 [Wang Deyi] and 姚奕 [Yao Yi], 通信信道选择对潜舰导弹攻击的影响 ["Influence of Communication Channel Selection on Submarine-to-Ship Missile Attack"], *舰船电子工程 [Ship Electronic Engineering]* 41, no. 8 (August 2021), p. 134.

<sup>44</sup> *Ibid.*, p. 136. The PLAN has operated a copy of the U.S. Navy/NATO Link-11 datalink that operates in HF- and UHF-bands. The PLA has also fielded a copy of the U.S. Link-16 joint service data link that operates in the UHF-band. See, J. Michael Dahm, *South China Sea Military Capability Series: Inter-Island Communications* (Laurel, MD: JHU Applied Physics Laboratory, 2021), pp. 10-12, <https://www.jhuapl.edu/sites/default/files/2022-12/Inter-IslandCommunications.pdf>.

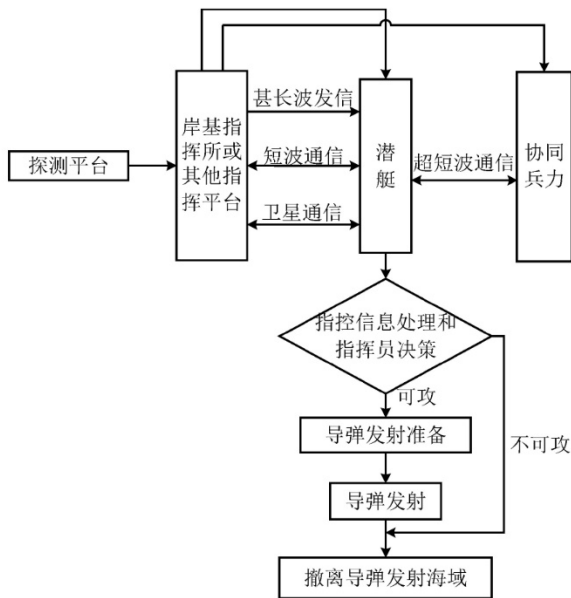


图1 潜舰导弹外部信息引导攻击流程

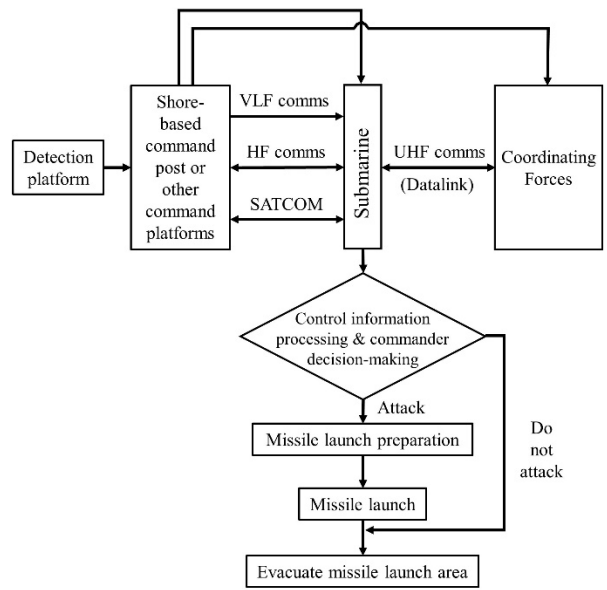


Fig. 1 The attack process of submarine missile using external information

Figure 6. Information Flow in a Submarine-to-Ship Long-Range Missile Attack

Some of the limits and variables calculated in the paper are telling. For example, the maximum missile range considered in the calculations was 500 kilometers with the missile speed of 0.7 Mach (857.6 kilometers/hour), which is slightly less than the assessed range and cruising speed of the YJ-18. The PLA authors calculate the time necessary to process information at the command post and subsequent delays in submarine communications. Depending on the speed and relative motion of the target ship to the attacking submarine, the information transmission process could result in a 60 percent reduction in the effective engagement range of the missile. Unsurprisingly, the use of VLF transmission, the only form of communication that allows the submarine to remain submerged without raising a communications antenna, increased the attack time by 2-4 minutes and further reduced the missile's effective engagement range against a high-speed surface target.<sup>45</sup>

While the example given in this journal article is theoretical, it makes the point that in order to exploit the full potential and range of PLAN long-range weapon systems, the PLAN may need to explore new C2 and communications arrangements. Reducing targeting and communications times may involve skip-echelon C2 or "sensor-to-shooter" information flows in which the submarine receives targeting information directly from detection platforms. Such an arrangement would necessitate the MOSC or intermediary command post to delegate firing authority to a submarine. In such a scenario, the submarine would also need onboard capabilities to process and interpret sensor data to make targeting decisions.

<sup>45</sup> Ibid., p. 135. For HF, SATCOM and UHF communications, the missile had a high probability of acquiring and striking a maneuvering target traveling at 30 knots at ranges less than 200 kilometers. Due to the low transmission rate and long transmission time of VLF, the submarine launched missile could only engage a 25 knot target at ranges less than 250 kilometers.

### *Command and Control of Strategic Assets*

Following the “above” and “below-the-neck” reforms of 2015 and 2017, the CMC probably maintains close oversight of PLAN submarine operations of strategic significance such as PLAN SSBNs on nuclear deterrent patrols. As with force structure changes to the PLAN submarine fleet and changes to joint operational/tactical-level C2 relationships examined elsewhere in this report, drivers of change in strategic-level command and control have been the infusion of new technologies and new capabilities in the PLAN and its submarine force.

Prior to the 2015 “above-the-neck” reforms, the CMC empowered the General Staff Department and the PLAN to exercise C2 over its nascent nuclear powered ballistic missile submarine fleet.<sup>46</sup> In wartime, Chinese military theory held that the PLA would transition from a peacetime organizational structure to a joint wartime C2 structure. All forces would be under the centralized, unified command of the “Supreme Command” (统帅部).<sup>47</sup> If required, the Supreme Command would provide guidance and combat orders for the use of nuclear weapons.<sup>48</sup> China’s 2002 Defense White Paper highlighted that the then PLA Second Artillery’s (now the PLARF) missions included launching an effective counterattack independently or jointly with the strategic nuclear forces of other services on the order of the Supreme Command.<sup>49</sup>

Little information is available on the composition of the Supreme Command. At a minimum, the body almost certainly included CMC members and potentially select General Staff Department officers with key operational roles. The Supreme Command also likely had a dedicated strategic communications body, responsible for establishing communications with each of the services.<sup>50</sup> The General Staff Department in peacetime and the Supreme Command in wartime probably coordinated and deconflicted nuclear operations between the Second Artillery and the PLAN, as the two forces probably maintained separate C2 and communications infrastructures to support their respective conventional and nuclear forces.

“Above-the-neck” reforms may have eliminated the need for nuclear C2 to transition from peacetime to wartime authorities. Nuclear release authority almost certainly still resides with the “Supreme Command”—the CMC or, more likely, its Chairman, Xi Jinping. Day-to-day C2 over SSBNs and other nuclear forces has likely been consolidated under the JOCC as part of its responsibilities for commanding joint operations across the PLA. In late 2021, the CMC JOCC was elevated to a standalone entity and the highest combat command organ, purportedly to better manage strategic C2 matters including nuclear, cyber, and space operations.<sup>51</sup> As a central node with operational leaders

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<sup>46</sup> “China’s National Defense in 2002,” PRC State Council Information Office, December 2002, <http://www.china.org.cn/e-white/20021209/index.htm>.

<sup>47</sup> Ibid.; U.S. Air Force China Aerospace Studies Institute (CASI), *In Their Own Words: PLA’s Science of Military Strategy (2013)*, 8 February 2021, pp. 262, 298-299, [www.airuniversity.af.edu/CASI/Display/Article/2485204/plas-science-of-military-strategy-2013/](http://www.airuniversity.af.edu/CASI/Display/Article/2485204/plas-science-of-military-strategy-2013/).

<sup>48</sup> “China’s National Defense in 2002”; PLA, Second Artillery Force, 第二炮兵战役学 [*The Science of Second Artillery Campaigns*] (Beijing: PLA Press, 2004), pp. 294-296, and U.S. Air Force CASI, *In Their Own Words: PLA’s Science of Military Strategy (2013)*, pp. 262, 298-299.

<sup>49</sup> “China’s National Defense in 2002.”

<sup>50</sup> 战略通信指挥机构 [“Command Organs of Strategic Communications”], 中国军事通信百科全书 [*China Military Communications Encyclopedia*] (Beijing: Encyclopedia of China Publishing House, 2009), pp. 851.

<sup>51</sup> 中华人民共和国中央人民政府 [PRC State Council], 习近平视察军委联合作战指挥中心 [“Xi Jinping Inspects the Central Military Commission Joint Operations Command Center”], 新华社 [Xinhua News Agency], 8 November 2022, [www.gov.cn/xinwen/2022-11/08/content\\_5725502.htm](http://www.gov.cn/xinwen/2022-11/08/content_5725502.htm).

from across the PLA, the JOCC almost certainly has the responsibilities for maintaining nuclear readiness and coordinating nuclear operations across the PLAN, PLARF, and PLAAF.

How the JOCC is presented in public forums provides evidence of the JOCC's integration with the CMC and its strategic C2 responsibilities that extend beyond simply coordinating activities of operational theaters. For example, the CMC JOCC was listed independently in the PLA's official announcement of the participating units for the September 2022 National Defense and Military Reform Seminar in Beijing.<sup>52</sup> During the seminar and then again at the National People's Congress in October 2022, General He Weidong (何卫东), now Vice Chairman of the CMC, was seen wearing a CMC JOCC uniform patch.<sup>53</sup> During his 8 November 2022 visit to the JOCC, Xi Jinping also highlighted the JOCC's important position in implementing the strategic command of the Party Central Committee and the CMC.<sup>54</sup> Key leadership further highlights the JOCC's strategic role. JOCC leadership includes Lieutenant General Li Jun (李军), a career PLARF officer. Li's last two postings were as a Joint Staff Department Deputy Chief of Staff and a PLARF deputy commander, suggesting his probable role in managing the nuclear forces.<sup>55</sup>

According to the U.S. Department of Defense, the PLA has likely begun "near continuous" deterrence patrols with its *Jin*-class (Type 094) SSBNs.<sup>56</sup> The *Jin*-class SSBNs are equipped to carry up to 12 JL-2 (巨浪-2) or JL-3 intercontinental-range submarine launched ballistic missiles (SLBMs). The reported range of the JL-2 (~3,888 nautical miles/7200 kilometers) would require a *Jin* SSBN to operate in the Central Pacific, north or east of Hawaii to target all of the United States. The extended range of the follow-on JL-3 SLBM (~4860 nautical miles/9000 kilometers) allows the *Jin* SSBNs to potentially target the continental United States from waters near mainland China.<sup>57</sup> It is unclear whether the PLAN routinely deploys their SSBNs with nuclear warheads mated to their SLBMs. Previously, the Second Artillery/PLARF maintained a long-held policy of securing nuclear weapons in central storage until they were required in a crisis.<sup>58</sup> This feature of China's nuclear

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<sup>52</sup>视频:中国共产党第二十届中央委员会第一次全体会议公报 [Communique of the First Plenary Session of the 20th Central Committee of the Communist Party of China], CCTV, 23 October 2022, <https://tv.cctv.com/2022/10/23/VIDE2GtsMTxRikfeNfMkbfPp221023.shtml>; 国防军事早报:习近平对国防和军队改革研讨会作出重要指示强调 认真总结运用改革成功经验 奋力开创改革强军新局面 [Xi Jinping Gave Important Instructions at the National Defense and Military Reform Seminar], CCTV, 22 September 2022, <https://tv.cctv.com/2022/09/22/VIDEiAF99DvNuB7Ymh8pkOgi220922.shtml>.

<sup>53</sup> In prior PLA announcements, the CMC JOCC was assumed to be part of the reference to "all departments of the CMC" rather than independently listed for attendance at a meeting. In similar PLA meetings, participants wore patches from one of the 15 CMC departments, 3 commissions, 5 affiliated bodies, 3 schools, 5 theaters, 4 services, and/or the 2 supporting forces.

<sup>54</sup> 习近平在视察军委联合作战指挥中心时强调 贯彻落实党的二十大精神 全面加强练兵备战" ["When Xi Jinping Inspected the Central Military Commission Joint Operation Command Center, He Emphasized the Implementation of the Spirit of the 20th National Party Congress and Comprehensively Strengthened Military Training and Preparations"], 新华社 [Xinhua News Agency], 8 November 2022, [http://www.81.cn/2022zt/2022-11/08/content\\_10199028.htm](http://www.81.cn/2022zt/2022-11/08/content_10199028.htm).

<sup>55</sup> 博士中将李军出任火箭军副司令 ["PhD Lieutenant General Li Jun Served as PLA Rocket Force Deputy Commander"], 北京日报 [Beijing Daily], 25 May 2020, <https://bj.bjd.com.cn/5b165687a010550e5ddc0e6a/contentShare/5b16573ae4b02a9fe2d558f9/AP5ecb66afe4b0be621cbe20f0.html>; CCTV, 军事报道:习近平在出席军队领导干部会议时强调 认真学习宣传贯彻党的二十大精神 奋力实现建军一百年奋斗目标 [Xi Jinping at Military Leading Cadre Meeting], 4 October 2022, <https://tv.cctv.com/2022/10/24/VIDE839Kbzlh9esGSQGy76JK221024.shtml>.

<sup>56</sup> Office of the U.S. Secretary of Defense, *CMPR*, p. 96.

<sup>57</sup> *Ibid.* pp. 94-96.

<sup>58</sup> Zhao Tong, "China's Sea-Based Nuclear Deterrent", Carnegie Endowment for International Peace, 30 June 2016, <https://carnegieendowment.org/2016/06/30/china-s-sea-based-nuclear-deterrent-pub-63909>.

posture reflected its historical reliance only on its ground-based missiles to provide assured nuclear retaliation capabilities (also referred to as assured second strike). However, given Xi Jinping's direction to the PLA to prepare to fight and win wars and the emphasis on realistic combat training, it is possible that PLAN SSBNs on deterrence patrols do, in fact, carry nuclear warheads on their SLBMs.

It also remains unclear whether the CMC has decided to trust its SSBN fleets with pre-launch authorities or what procedures might be followed if the JOCC loses contact with an SSBN or the submarine loses contact with the JOCC or other military commands. PRC academics have asserted that the PLA lacks sufficient advanced technologies to maintain communications with its SSBNs on patrol without the submarines revealing their position and risking attack by enemy forces.<sup>59</sup> Issues surrounding secure, reliable communications with PLAN SSBNs may force Beijing to delegate launch authorities for nuclear weapons and assume the risks associated with providing a SSBN commander with autonomy to fire the submarine's missiles.<sup>60</sup> Recent reporting on the construction of dozens of underground nuclear missile silos indicates that China may be moving toward an "early warning counterattack (预警反击)" or launch-on-warning posture for its ground-based nuclear missiles.<sup>61</sup> The question remains if the PLA has the same risk tolerance and confidence in its C2 processes and communications infrastructure to include SSBNs in a launch-on-warning posture.

Very little information is available on PLA submarine nuclear command, control, and communication (NC3). For both operational and strategic submarine operations and deployments, the PLAN seeks to improve its assured communications, emphasizing reliability, resiliency, and redundancy. In the coming years, the PLA and the PLAN will likely pursue an upgrade or expansion of existing satellite and relay communication systems and further develop two-way data transmission between various operational platforms. These requirements include communications methods that reduce the probability that an adversary will be able to detect and geolocate them.<sup>62</sup> Anecdotal reporting indicates PLAN submarines, like their Western counterparts, rely on very low frequency (VLF), super low frequency (SLF), and extremely low frequency (ELF) communications.<sup>63</sup>

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<sup>59</sup> Communications that could be geolocated by an adversary presumably include satellite communications or other communications technologies that would require the SSBN to operate near or at the surface. Zhao Tong, "Tides of Change: China's Nuclear Ballistic Missile Submarines and Strategic Stability", Carnegie Endowment for International Peace, 24 October 2018, <https://carnegieendowment.org/2018/10/24/tides-of-change-china-s-nuclear-ballistic-missile-submarines-and-strategic-stability-pub-77490>.

<sup>60</sup> Ibid.

<sup>61</sup> Steven Lee Myers, "China Bolsters Its Nuclear Options with New Missile Silos in a Desert," *New York Times*, 2 July 2021 (Updated 3 November 2021), <https://www.nytimes.com/2021/07/02/world/asia/china-missile-silos.html>

<sup>62</sup> 陈明 [Chen Ming] and 尹晓飞 [Yin Xiaofei], 提升我水下攻防作战能力的对策措施 ["Measures to Improve Undersea Warfare Capabilities"], 数字海洋与水下攻防 [Digital Ocean & Underwater Warfare], no. 1, (March 2019), pp. 1-3, and Wu Riqiang, "Survivability of China's Sea-Based Nuclear Forces," *Science & Global Security* 19, (2011), pp. 91-121, <https://doi.org/10.1080/08929882.2011.586312>; 吴日强 [Wu Riqiang], 军备竞赛:中国核潜艇如何突破第一岛链? ["Arms Race: How Does China's Nuclear Submarine Break Through the First Island Chain?"], 澎湃研究所 [The Paper], 13 March 2018, [https://m.thepaper.cn/newsDetail\\_forward\\_2023832](https://m.thepaper.cn/newsDetail_forward_2023832).

<sup>63</sup> Fiona Cunningham, "Nuclear Command, Control, and Communications Systems of the People's Republic of China", NAPSNet Special Reports, 18 July 2019, <https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-systems-of-the-peoples-republic-of-china/>; Vinayak Bhat, "Unearthing China's Communication Efforts to Assist Long-Distance Submarines", *India Today*, 2 November 2020, <https://www.indiatoday.in/news-analysis/story/china-communication-efforts-nuclear-submarines-1737292-2020-11-02>; Phillip C. Saunders, Testimony Before the U.S.-China Economic and Security Review Commission Hearing on China's Nuclear Forces, 10 June 2021,

The PLAN is also interested in the development of undersea communications technologies, including the use of undersea acoustics, blue-green lasers, magnetic induction, neutrino beams, gravitational waves, and quantum communications for operational communications purposes.<sup>64</sup> In 2017, Chinese scientists reported they had successfully completed a seawater quantum communication experiment, verifying the feasibility of underwater quantum communication for the first time. This was apparently viewed by the PLAN as an important step toward developing a joint communications network integrating submarines in the future.<sup>65</sup>

Improvements in submarine communications will be linchpin technologies that enable future PLAN strategic deterrent patrols. The guarantee of secure, reliable communications that do not require a submarine to reveal its position to adversary reconnaissance will provide Beijing with greater confidence in its sea-based nuclear deterrent and enhance its ability to coordinate nuclear strike and counterstrike options among the PLA services. Such communications will also relieve the pressure on the JOCC and Supreme Command to delegate nuclear launch authorities.

#### *Foreign Exercises and Far Seas Command & Control*

Since 2013, the PLA has deployed its submarines beyond the first island chain with increasing frequency, creating new challenges for PLAN submarine C2. These deployments reflect the PLAN's far seas protection (远海防卫) naval strategy and aspirations to operate globally.<sup>66</sup> In 2021, a *People's Navy* newspaper article highlighted the achievements of PLAN nuclear submarines, including transitioning from “yellow water” (黄水) to “blue water” (蓝水) deployments. The article asserted that recent PLAN submarine deployments had gone farther and deeper into the Indian Ocean and Western Pacific than ever before.<sup>67</sup>

The PLA first deployed a *Shang*-class nuclear powered submarine and *Song*-class diesel-electric submarine to the Indian Ocean in 2013. The PLAN may have repeated these deployments periodically to conduct long-distance voyage training and (Beijing claims) to support counter-piracy escort operations in the Indian Ocean.<sup>68</sup> The PLA has also ventured to distant shores to integrate its

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[https://www.uscc.gov/sites/default/files/2021-06/Phillip\\_Saunders\\_Testimony.pdf](https://www.uscc.gov/sites/default/files/2021-06/Phillip_Saunders_Testimony.pdf); and Stephen Chen, “China Antenna Turns Earth into Giant Radio Station, with Signals Reaching Guam,” *South China Morning Post*, 2 December 2021, <https://www.scmp.com/news/china/science/article/3158162/china-antenna-turns-earth-giant-radio-station-signals-reaching>.

<sup>64</sup> 陈熙 [Chen Xi] and 李刚 [Li Gang], 打开龙宫信息传递之窗 [“Open the Legendary Palace of the Dragon King Window of Information Transmission”], 人民海军 [*People's Navy*], 22 June 2018, p. 4; 李智生 [Li Zhisheng] and 张强 [Zhang Qiang], 深海预置武器系统发展现状及关键技术 [“Development Situation and Key Technologies for Deep-Sea Prepositioned Weapon Systems”], 船舶电子工程 [*Ship Electronic Engineering*], vol. 40, no. 2 (2020), pp. 1-3, 41.

<sup>65</sup> Chen and Li, “Open the Legendary Palace of the Dragon King Window of Information Transmission,” p. 4.

<sup>66</sup> 胡冬英 [Hu Dongying], 黄锐 [Huang Rui], and 蔡广友 [Cai Guangyou], 推进潜艇兵力走向远洋的几点思考 [“Several Thoughts on Advancing the Submarine Force to Distant Oceans”], 舰船电子工程 [*Ship Electronic Engineering*], no. 1 (2017), p. 3; 李建林 [Li Jianlin], 王瑞臣 [Wang Ruichen], and 徐利明 [Xu Liming], 外军潜艇轮换及启示 [“Lessons from Foreign Submarine Rotation”], 舰船电子工程 [*Ship Electronic Engineering*], no. 9 (2019), pp. 4-7.

<sup>67</sup> 用新时代海军精神照亮潜航之路 [“Illuminate the Road for the Submarine with the Spirit of the Navy in the New Era”], 人民海军 [*People's Navy*], 15 January 2021, p. 3; Hu, Huang, and Cai, “Several Thoughts on Advancing the Submarine Force to Distant Oceans,” p. 3.

<sup>68</sup> “PLA Submarines in the Indian Ocean Legitimate: China”, *Economic Times*, 12 July 2018, <https://m.economictimes.com/news/defence/pla-submarines-in-indian-ocean-legitimate-china/articleshow/53100318.cms>; 黑金 [Hei Jin], 中国和潜艇前出印度洋的最大障碍 [“The Biggest Obstacle to Chinese Nuclear Submarines Going Out into the Indian Ocean”], 现代舰船 [*Modern Ships*], no. 11-12 (2020), pp. 71-76; Sam LaGrone, “Chinese Submarine

submarines in operations with foreign militaries. These military diplomacy events provide the PLAN with valuable experience and exposure to unfamiliar operating environments. Notable activities include port visits to Pakistan, Sri Lanka, Bangladesh, Myanmar, Malaysia, and Singapore and a number of bilateral and multilateral training exercises.<sup>69</sup>

Since at least 2019, PLAN submarines may have participated in joint China-Russia maritime exercises. For Joint Sea-2019 (海上联合-2019), China and Russia dispatched two submarines, thirteen surface ships, fixed-wing aircraft, helicopters, and marines to participate in the exercise conducted in the Yellow Sea. Joint Sea-2019 focused on combined China-Russia operations with a focus on integration of submarine rescue and anti-submarine operations.<sup>70</sup> This was likely the first time China included a submarine in an exercise with Russia. China's Ministry of National Defense highlighted that it was the first time the respective navies rescued the other's submarine crew members, conducted joint anti-submarine maneuvers with surface ships and aircraft, and performed joint missile live-fires.<sup>71</sup> Joint Sea-2020 was not held due to COVID-19 restrictions. In subsequent exercises—Joint Sea-2021 held in the Sea of Japan and Joint Sea-2022 held in the East China Sea—both China and Russia disclosed that the PLA contributed a diesel submarine to the exercises.<sup>72</sup> Bilateral exercises with the Russian Navy expose PLAN submarine personnel to new operational tactics and procedures and help the PLAN to identify strengths and vulnerabilities in China's submarine operations.

In 2020, China also began to pursue naval exercises with Pakistan that included submarine operations. China and Pakistan held a joint naval exercise, "Sea Guardians-2020," featuring inaugural bilateral training in anti-submarine warfare and submarine rescue.<sup>73</sup> PLAN submarine participation in the 2020 exercise is unconfirmed. However, the Sea Guardians-2022 exercise near Shanghai did feature participation by a PLAN submarine in addition to other naval and air assets conducting joint maneuvers and anti-submarine drills.<sup>74</sup>

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Headed to Gulf of Aden for Counter Piracy Operations," *USNI News*, 30 September 2014, <https://news.usni.org/2014/09/30/chinese-submarine-headed-gulf-aden-counter-piracy-operations>.

<sup>69</sup> Hu, Huang, and Cai, "Several Thoughts on Advancing the Submarine Force to Distant Oceans," p. 3; "Chinese Submarine Confirmed a Stopover in Malaysia," *People's Daily*, 10 January 2017, [http://china.org.cn/china/2017-01/10/content\\_40067691.htm](http://china.org.cn/china/2017-01/10/content_40067691.htm); "Chinese Sub Docks at Malaysian Port for Second Time This Year," *Reuters*, 13 September 2017, <https://www.reuters.com/article/us-china-malaysia-southchinasea/chinese-sub-docks-at-malaysian-port-for-second-time-this-year-idUSKCN1BO17P>.

<sup>70</sup> 炮火震天狂飙突起鏖战急 ["Cannon Fire Shakes the Sky, Hurricanes Rise and Fight Fiercely"], 人民海军 [*People's Navy*], 6 May 2019, p. 4.

<sup>71</sup> "Defense Ministry's Regular Press Conference on May 30", *China Military*, 30 May 2019, [http://eng.chinamil.com.cn/CHINA\\_209163/TopStories\\_209189/9519337.html](http://eng.chinamil.com.cn/CHINA_209163/TopStories_209189/9519337.html).

<sup>72</sup> "Joint Sea 2021 Russian-Chinese Naval Exercise Starts in Sea of Japan", *China Military*, 14 October 2021, [http://eng.chinamil.com.cn/INTERNATIONALREPORTS\\_209193/InternationalMilitariesReportsonChina/10099243.html](http://eng.chinamil.com.cn/INTERNATIONALREPORTS_209193/InternationalMilitariesReportsonChina/10099243.html) and "China-Russia Naval Exercise "Joint Sea-2022" Demonstrates Both Sides' Ability to Safeguard Peace and Stability: Defense Spokesperson", *China Military*, 29 December 2022, [http://eng.chinamil.com.cn/VOICES/MinistryofNationalDefense\\_209794/16199221.html](http://eng.chinamil.com.cn/VOICES/MinistryofNationalDefense_209794/16199221.html).

<sup>73</sup> Liu Xuanzun, "China, Pakistan Joint Naval Exercise First in a Series", *Global Times*, 7 January 2020, <https://www.globaltimes.cn/content/1176034.shtml>

<sup>74</sup> Liu Xuanzun, "China-Pakistan Joint Drills Strengthen Ties, Enhance Interoperability Between the Two Navies: Pakistani Naval Chief", *China Military*, 11 January 2023, [http://eng.chinamil.com.cn/WORLD\\_209198/WorldMilitaryAnalysis/16199290.html](http://eng.chinamil.com.cn/WORLD_209198/WorldMilitaryAnalysis/16199290.html).

How PLAN submarines may be organized or controlled for far seas operations and foreign training evolutions is not entirely clear. Prior to the “above-the-neck” and “below-the-neck” reforms, PLAN headquarters was likely responsible for C2 of far seas naval deployments, including the limited number of out-of-area submarine deployments. In support of PLAN C2, the General Staff Department would likely coordinate necessary intelligence and logistics support. Post-reforms, it appears that the C2 of PLAN forces in the far seas has been assumed by the Joint Staff Department (JSD). In 2016, as part of the “above-the-neck” reforms, an Overseas Operations Office (海外行动处) was established under the JSD Operations Bureau. The Overseas Operations Office is responsible for planning, preparation, and implementation of non-war overseas military operations; coordinating and organizing peacekeeping operations, overseas escorts, international rescues, overseas Chinese evacuations, and joint exercises with foreign militaries; and establishing a coordination mechanism for overseas operations with Chinese state agencies.<sup>75</sup> However, how this office relates to the CMC’s Joint Operations Command Center (JOCC) is unknown.

Since the two rounds of organizational reform, Beijing has likely experimented with new C2 structures for overseas military operations. A 2020 U.S. National Defense University analysis postulated a range of options the PLA might pursue as its expeditionary capabilities and aspirations increase in the coming years. Possibilities for far seas C2 include having the JOCC command far seas operations, establishing a PLA “global command,” establishing a new joint task force mechanism, or reverting to PLA service control of overseas operations.<sup>76</sup> Absent a new “global command,” the most likely future for large-scale PLA overseas operations would place the CMC JOCC in command.

There are questions about where JOCC command begins during far seas operations. Some evidence suggests that theater commands continue to exercise C2 beyond the first island chain. In 2019, for example, a PLAN task force reportedly operated far into the Central Pacific Ocean, beyond Guam and the Second Island Chain.<sup>77</sup> This formation, Task Force 174, was also called the “Southern Theater Command Navy Far Seas Joint Training Task Force” (南部战区海军远海联合训练编队).<sup>78</sup> The 2019 task force established a “training task force command post” (训练编队指挥所) that probably fell under the command of the Southern Theater Joint Operations Command Center (T-JOCC) Maritime Operations Sub-Center (MOSC).<sup>79</sup> It remains unclear how the PLA will grapple with operational control of combat forces including submarines in areas not directly related to a contingency on China’s periphery.

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<sup>75</sup> 中央军委联合参谋部作战局成立海外行动处 [“The Central Military Commission Joint Staff Department Operations Bureau Established the Overseas Operations Bureau”], 中国军网 [China Military Net], 31 March 2016, [http://www.81.cn/xwfy/2016-03/31/content\\_6986426.htm](http://www.81.cn/xwfy/2016-03/31/content_6986426.htm).

<sup>76</sup> Phillip C. Saunders, “Beyond Borders: PLA Command and Control of Overseas Operations”, *Strategic Forum*, no. 306 (July 2020), <https://inss.ndu.edu/Portals/68/Documents/stratforum/SF-306.pdf>.

<sup>77</sup> Ryan D. Martinson, “China’s Far Seas Naval Operations, From the Year of the Snake to the Year of the Pig,” Center for International Maritime Security, 18 February 2019, <https://cimsec.org/chinas-far-seas-naval-operations-from-the-year-of-the-snake-to-the-year-of-the-pig/>.

<sup>78</sup> 南部战区海军远海联合训练编队紧贴实战练兵影像 [“Images of the Southern Theater Command Navy Far seas Joint Training Task Force’s Actual Combat Training”], 解放军报 [PLA Daily], 19 February 2019, p. 9, cited in Lee and Clemens, “Organizing to Fight in the Far Seas,” p. 6.

<sup>79</sup> 港媒：中国海军远海训练测试“联合指挥中枢” [“Hong Kong Media: Chinese Navy Far seas Training Tests ‘Joint Command Backbone’”], 环球时报 [Global Times], 22 February 2019, <https://mil.huanqiu.com/article/9CaKrnKijKb>, cited in Lee and Clemens, “Organizing to Fight in the Far Seas,” p. 6.



### *Transitioning from “Above-” to “Below-the-Neck” Reforms*

To summarize this section, “above-the-neck” reforms resulted in significant changes to national- and theater-level command and control that ultimately impacted submarine operations down echelon. The PLA has adopted a “joint operational command system” with theater joint operation command centers (T-JOCC) and established a PLAN-run theater maritime operations sub-center (MOSC) in each theater. All theater surface and undersea forces as well as airborne assets conducting maritime missions will likely be under the positive control of the MOSC. The CMC probably maintains close oversight of PLAN submarine operations of strategic significance such as PLAN SSBNs on nuclear deterrent patrols. The CMC probably also maintains C2 of maritime combat forces including submarines operating in the far seas. Still, theater commands and their MOSCs have demonstrated C2 of forces conducting operations that extend well beyond the First Island Chain.

Change in PLAN submarine C2 from the strategic-level to the tactical-level has been significantly influenced by the adoption of new technologies, new PLAN ships and aircraft, and new, longer-range weapons in the submarine force. Changes to submarine force structure as part of “below-the-neck” reforms were also driven by evolutions in submarine technology. Newly constructed submarines that arrived in the fleet since 2017 extended the range and capabilities of the PLAN in conjunction with the retirement of what remained of an older generation of PLAN submarines.

### **Section 2. “Below-the-Neck” Reforms and Impacts on the Submarine Force**

By early 2017, the PLA initiated “below-the-neck” reforms focused on the PLA’s “body,” targeting lower-echelon commands and forces. To achieve those aims, the PLA took steps to “optimize the size, structure, and composition” (优化规模结构和力量编成) of its services.<sup>80</sup> “Below-the-neck” reforms were driven by what Xi Jinping had identified as the core function of China’s military—to fight and win wars. The imperative across the PLA was for services to align their respective organizations as well as their command and control to that end. Ultimately, the “below-the-neck” reforms were meant to resolve contradictions and create solutions that aligned the force toward joint capabilities and combat proficiency.<sup>81</sup>

PLA services took different approaches to “below-the-neck” reforms. The PLAA, which became a distinct service as part of the first round of reforms, experienced the most significant changes. The PLAA focused decidedly on size and structure. It consolidated and eliminated some group armies, abandoned its former Soviet organizational structure, and transformed regiments into combined arms brigades and battalions.<sup>82</sup> The PLAAF embarked on significant changes to its organizational structure, reforming command posts into bases, eliminating air divisions, and replacing air regiments

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<sup>80</sup> 李金海 [Li Jinhai] and 王诗敏 [Wang Shimin], 新的军队领导指挥体制“四梁八柱”已经成功搭建 [“The New Army Leadership and Command System’s Successful Establishment of ‘Four Beams and Eight Pillars’”], 澎湃新闻 [The Paper], 1 August 2016, [https://www.thepaper.cn/newsDetail\\_forward\\_1506884](https://www.thepaper.cn/newsDetail_forward_1506884). See also, “China’s National Defense in the New Era,” The State Information Office of the People’s Republic of China, July 2019, <http://www.chinadaily.com.cn/specials/whitepaperonnationaldefenseinnewera.pdf>. The Chinese version of this document is available here: [https://www.gov.cn/zhengce/2019-07/24/content\\_5414325.htm](https://www.gov.cn/zhengce/2019-07/24/content_5414325.htm).

<sup>81</sup> 陶伶 [Tao Ling] and 余远来 [Yu Yuanlai], 确立与改革相适应的思维方式 [“Establish a Way of Thinking Adapted to Reform”], 解放军报 [PLA Daily], 31 May 2017, p. 7.

<sup>82</sup> For a discussion of reforms in the PLAA see Dennis J. Blasko, “The Biggest Loser in the Chinese Military Reforms: The PLA Army,” in Saunders et al, *Chairman Xi Remakes the PLA*, p. 346.

with air brigades.<sup>83</sup> In contrast to the significant reorganizations experienced by the PLAA and PLAAF, the PLAN focused largely on the size, composition, and quality of its force and saw relatively few changes to its organizational structure.

The “above-the-neck” reforms that began in 2015 set the stage for the follow-on “below-the-neck reforms.” In the first round of reforms, the PLA reorganized its seven military regions into five operational theaters: Eastern, Western, Northern, Central, and Southern. The theater commands are geographically oriented, each focusing on operations and contingencies in their respective cardinal directions. The Central Theater Command likely focuses on the defense of the capital, Beijing, and acts as a reserve for the other theaters.

Prior to the 2015 reforms, the PLAN was organized into three fleets: the North Sea Fleet, East Sea Fleet, and South Sea Fleet. In the wake of the reorganization, the PLAN retained its overarching structure, simply renaming the fleets as the Northern Theater Navy (NTN), Eastern Theater Navy (ETN), and Southern Theater Navy (STN). The lack of change to the PLAN’s legacy fleet structure during the “above-the-neck” reforms probably minimized subsequent impacts on the subordination and organization of flotillas and other operational units in “below-the-neck” reforms.

In “below-the-neck” reforms, the PLAN did reorganize and consolidate select commands responsible for near seas operations and coastal defense. Most mainland China maritime garrison districts (MGDs) were eliminated. Their naval base and coastal defense ships and units were handed over to six new operational bases.<sup>84</sup> As dozens of new frigates replaced older patrol boats, PLAN frigate detachments (dadui, 大队), which had previously been subordinate to destroyer flotillas, were elevated to frigate flotillas (zhidui, 支队).<sup>85</sup> Additionally, the PLAN Marine Corps saw significant growth, absorbing a number of PLAA units and expanding from two brigades to eight.<sup>86</sup> However, a wholesale, fleet-wide restructuring of the PLAN’s pre-reform organization, including submarine commands, did not manifest in the “below-the-neck” reforms.

Instead of resizing or reorganizing like the PLAA and PLAAF, PLAN submarine force reforms seem to have focused on how and where to add newly constructed submarines, the retirement of older submarines, and the attendant transfer of submarines and crews. The crews of retiring submarines likely did not simply transfer to newly commissioned submarines one-for-one. As part of the reforms, interfleet transfers of crews and submarines were necessary to distribute the basing of new submarines and balance the new capabilities they brought across the different fleets.

Beginning in 2017 and over the course of the next six years, potentially over a dozen submarines and/or crews were likely shuffled from one flotilla to another. These changes were significant for PLAN submarine personnel who were accustomed to operating from a single base or fleet

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<sup>83</sup> For a discussion of reforms in the PLAAF, see Kenneth W. Allen, Brendan S. Mulvaney, and James Char, “Ongoing Organizational Reforms of the People’s Liberation Army Air Force,” *Journal of Strategic Studies* 44, no. 2 (2021), p. 184, <https://doi.org/10.1080/01402390.2020.1730818>.

<sup>84</sup> Lee and Clemens, “Organizing to Fight in the Far Seas,” p. 7.

<sup>85</sup> 王俊 [Wang Jun], 军媒: “脖子以下”改革中, 东海舰队新组建某护卫舰支队 [“In the ‘Below-the-Neck’ Reforms, the East Sea Fleet Formed a New Frigate Detachment”], 澎湃新闻 [The Paper], 9 December 2017, [https://www.thepaper.cn/newsDetail\\_forward\\_1898350](https://www.thepaper.cn/newsDetail_forward_1898350). See also, Defense Intelligence Agency, *Directory of PRC Military Personalities* (Washington, DC: Defense Intelligence Agency, October 2022), pp. 83-148.

<sup>86</sup> Conor Kennedy, *The New Chinese Marine Corps*, China Maritime Report No. 15, China Maritime Studies Institute, October 2021, <https://digital-commons.usnwc.edu/cmsi-maritime-reports/15/>.

concentration area for most of their careers. Now officers, sailors, and families faced the challenge of transfers to unfamiliar parts of China. As part of an edict to slim down bloated PLA commands, a small number of submarine base or flotilla jobs were eliminated as part of the reforms. The demobilizations probably did not include submarine crew billets given the impending growth in the operational force.<sup>87</sup>

“Below-the-neck” reforms in the PLAN submarine force focused largely on adding newly constructed submarines—*Yuan* SSPs, *Shang* SSNs, and *Jin* SSBNs—and retiring older nuclear and conventional submarines, principally *Kilo* and *Ming* SSs. (See Table 1 above.) Reports in 2022 of an anticipated increase in China’s nuclear submarine production combined with observed infrastructure improvements at PLAN nuclear submarine bases indicates that the PLAN submarine force will likely continue to undergo changes in force structure and basing due to the arrival of new submarines over the next several years.

#### *Flotilla-Level Organizational Reforms*

Under the newly named theater navies, the PLAN retained its pre-reform administrative structure. As in the pre-reform era, PLAN submarines are organized into bases (基地) and flotillas (支队). Bases are corps-grade commands that host nuclear submarines, while flotillas are division-grade units in charge of conventional submarines. Both submarine bases and flotillas report directly to their respective theater navies.<sup>88</sup> Figure 7 and Table 3 (below) provide details on the PLAN submarine force’s two submarine bases, six flotillas, and one training base. The table lists the military unit cover designator (MUCD), a five-digit number for a military unit (部队) that substitutes for the unit’s true name. The table also shows how submarine types associated with each unit have changed since “below-the-neck” reforms began in 2017. For additional details on PLAN submarine units, see the appendix.

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<sup>87</sup> 肖明阳 [Xiao Mingyang], 洪利峰 [Hong Lifeng], 茆琳 [Mao Lin], 千条跟帖彰显军人本色 [“Thousands of Posts Show the True Qualities of Military Personnel”], 人民海军 [People’s Navy], 13 March 2017, p. 2.

<sup>88</sup> Grades apply to both personnel and commands/units. For a discussion of the PLA grade system, see Kenneth Allen, “China Announces Reform of Military Ranks,” *China Brief* 17, no. 2 (30 January 2017), <https://jamestown.org/program/china-announces-reform-military-ranks/>.

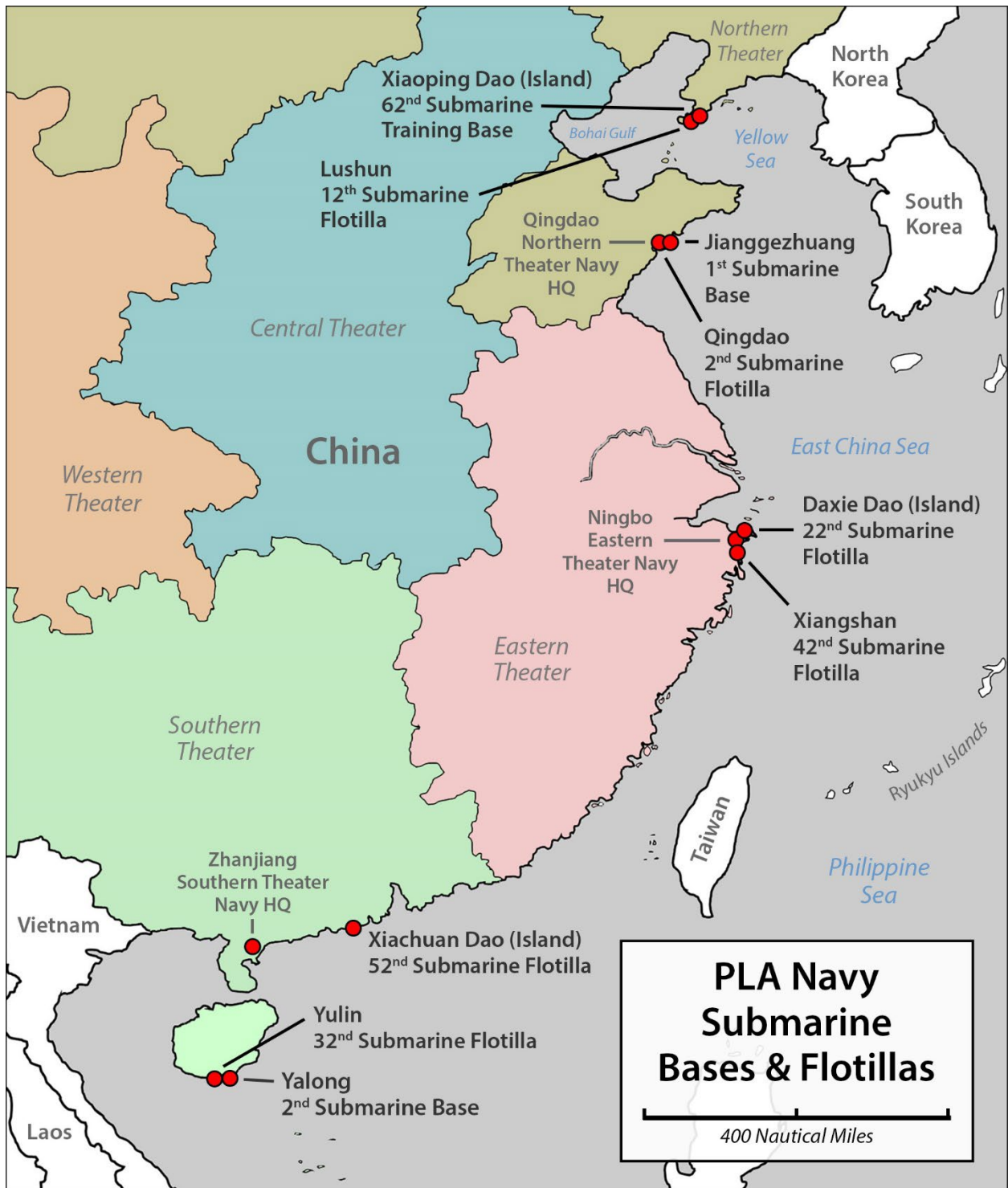


Figure 7. PLAN Headquarters, Submarine Bases, and Flotillas

Table 3. PLA Theater Navy Submarine Bases and Flotillas<sup>89</sup>

Unit	MUCD	Location	Submarines as of March 2023 (Net change since 2017)	
Northern Theater Navy (North Sea Fleet)				
1 <sup>st</sup> Submarine Base	92330	Jianggezhuang, Shandong	0 x <del>Xia</del> SSBN 0 x <del>Han</del> SSN 4 x <i>Shang</i> SSN	(-1) <sup>a</sup> (-3) <sup>a</sup> (+2) <sup>b</sup>
2 <sup>nd</sup> Submarine Flotilla	92196	Qingdao, Shandong	7 x <i>Song</i> SS	(-2) <sup>c</sup>
12 <sup>th</sup> Submarine Flotilla	92763	Lushun, Liaoning	7 x <i>Yuan</i> SSP 0 x <del>Ming</del> SS	(+4) (-5)
62 <sup>nd</sup> Submarine Training Base	92337	Xiaoping Dao (Island), Liaoning	1 x <i>Qing</i> SSA	
Eastern Theater Navy (East Sea Fleet)				
22 <sup>nd</sup> Submarine Flotilla	92858	Daxie Dao (Island), Zhejiang	10 x <i>Yuan</i> SSP	(+/- 0) <sup>d</sup>
42 <sup>nd</sup> Submarine Flotilla	92815	Xiangshan, Zhejiang	6 x <i>Kilo</i> SS	(-2)
Southern Theater Navy (South Sea Fleet)				
2 <sup>nd</sup> Submarine Base	92730	Yalong, Hainan	6 x <i>Jin</i> SSBN 2 x <i>Shang</i> SSN	(+2) <sub>b</sub>
32 <sup>nd</sup> Submarine Flotilla	92474	Yulin, Hainan	3 x <i>Yuan</i> SS 4 x <i>Kilo</i> SS 4 x <i>Song</i> SS	(+3)
52 <sup>nd</sup> Submarine Flotilla	91024	Xiachuan Dao (Island), Guangdong	2 x <i>Song</i> SS 3 x <i>Ming</i> SS	(+2) <sup>c</sup> (-4)

<sup>a</sup> 1 x *Xia* SSBN and 3 x *Han* SSN probably in caretaker status; awaiting decommissioning as of early-2023.

<sup>b</sup> One additional *Shang* launched May 2022, another launched early-2023 for total OOB of 8 x *Shang* once new subs are commissioned, probably in 2024. The future homeport for these new SSNs is probably Yalong.

<sup>c</sup> 2 x *Song* SS transferred from Qingdao to Xiachuan Island in 2017.

<sup>d</sup> The 22<sup>nd</sup> Submarine Flotilla probably returned to a complement of 10 x *Yuan* SSPs by 2023 having replaced submarines transferred to Lushun or Yulin with several new-construction *Yuans*.

The existence of PLAN administrative organizations below the flotilla-level are not prominent in public discussions of PLAN submarines. Nominally, a PLAN submarine flotilla has eight submarines.<sup>90</sup> Flotilla submarines are probably sub-divided into groups (大队) or squadrons (中队)

<sup>89</sup> Table data derived from multiple sources including official PLA media, military enthusiast blogs, unit affiliations noted in journal articles, and social media posts. Order of battle information aggregated from trade sources such as IISS, Janes, *Modern Chinese Maritime Forces* (Meyer, 2023), and authors' review of commercial satellite imagery from 2015-2023. The maximum number of submarines observed at each base is typically 1-2 fewer than estimated order of battle due to submarines on patrol or long-term maintenance.

<sup>90</sup> Henry Boyd, "China's Submarine Force: An Overview," *IISS Military Balance Blog*, 4 October 2017, <https://www.iiss.org/blogs/military-balance/2017/10/china-submarine-force>.

of submarines.<sup>91</sup> However, in Chinese military writings, those terms—groups and squadrons—appear to be commonly used to refer to U.S. or Russian submarine groupings with only an occasional mention about PLAN submarine unit organization.<sup>92</sup> Typically, Chinese language sources, such as the *PLA Daily* or *People's Navy* newspaper, simply refer to submarines of a certain flotilla with no reference to a squadron or other intermediary organizational element.<sup>93</sup>

### *Changes to Submarine Force Structure*

Shifts in PLAN submarine inventory and changes to force structure were labeled “below-the-neck” reforms. While the submarine transfers probably had significant impacts on the force and were correlated to the PLA-wide reforms, there is some question as to whether the moves would have happened even in the absence of a reform campaign. Between 2017 and 2023, the PLAN commissioned eleven new submarines—SSPs, SSNs and SSBNs. Concurrent with these gains, the PLAN retired at least fifteen submarines, which constituted the majority of an older generation of submarines including eleven diesel-electric boats (SSs) and four older nuclear-powered submarines that were at the end of their service life. Decommissioning the older submarines made trained submarine crew personnel available for newly commissioned units.

The older generation submarine retirements and arrival of newly constructed submarines threatened to create a disparity in quality and capability across the force. If the PLAN left submarine crews at their respective bases and simply replaced the oldest submarines with new-construction submarines, too many new submarines may have been concentrated at the wrong bases. For example, the 12<sup>th</sup> Submarine Flotilla at Lushun (Northern Theater) had three older generation *Yuan* SSPs and gained four *Yuans*. The 32<sup>nd</sup> Submarine Flotilla at Yulin (Southern Theater) had no *Yuan* SSPs and gained three. It is possible that all seven additions to Lushun and Yulin were newly constructed submarines. However, that would mean that the 22<sup>nd</sup> Submarine Flotilla at Daxie Island (Eastern Theater) would have been left with ten early generation *Yuan* SSPs, gaining *no* new-construction submarines. A more likely scenario probably had some early generation *Yuan* SSPs transferring from the Eastern Theater to the Northern and Southern Theaters. All theaters would then gain some new-generation *Yuan* SSPs.

The ensuing shuffle of submarines and personnel, which appears to have begun in earnest in 2017, was cast as the PLAN submarine force contribution to the “below-the-neck” reforms. The moves were likely tumultuous for those submarine crews that had to relocate with their boats to a new theater or were relocated to a new theater after their submarine was decommissioned. Previously, when new PLAN submarine officers or sailors were assigned to one of the three fleets, most could expect to remain in that fleet concentration area, sometimes in the same flotilla, until they retired or achieved a senior rank that warranted an interfleet transfer.<sup>94</sup> Upsetting PLAN convention, the transformation required crew members and their families to move to different fleets and different

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<sup>91</sup> According to Janes, each flotilla nominally comprises two four-boat squadrons. Janes, “China—Navy” (updated 19 May 2022), in *World Navies* (updated 8 February 2023), accessed 19 March 2023, [www.janes.com](http://www.janes.com).

<sup>92</sup> Xiao, Hong, and Mao, “Thousands of Posts Show the True Qualities of Military Personnel,” p. 2.

<sup>93</sup> Within the context of the PLA’s MUCD hierarchy, individual submarines likely correlate to “units” (分队). For example, “90 分队 92730 部队” is likely a submarine of the 2<sup>nd</sup> Submarine Base. See 南海舰队核潜艇部队露面, 或部署新型战略核潜艇 [“The South Sea Fleet’s Submarine Force Makes an Appearance, Deploys a New Type Strategic Nuclear Submarine”], 新浪军事 [*Sina Military*], 11 November 2013, <https://mil.news.sina.com.cn/2013-11-18/1739750118.html>.

<sup>94</sup> Anecdotal observations by the authors’ while working with the PLAN prior to the recent reforms indicated that a PLAN officer would typically remain within a specific fleet or fleet concentration area up through the rank of captain or senior captain. Enlisted personnel might spend more than a decade assigned to a particular base.

flotillas to effect the necessary changes and ensure an equitable distribution of new submarines across the force.

Open sources are challenged to provide a specific timeline for these inter-fleet transfers or at which base new-construction submarines entered the fleet. However, observations year-over-year at a given base offer a sense of when transfers were likely initiated. PLAN submarine personnel surely rotate on and off different crews and submarines. The speculation here about a trained crew from a decommissioned submarine being available for a new-construction submarine does not imply the old crew moved to the new boat as an integral unit. While the PLAN will certainly continue to “grow” new submariners, the initial crew for a newly commissioned submarine must necessarily draw from a pool of trained, experienced personnel from decommissioned units or other in-service units.

A March 2017 *People’s Navy* article addressed PLAN submarine crew concerns about the impending transfers ostensibly associated with “below-the-neck” reforms. The deputy commander of a Northern Theater Navy submarine flotilla involved in the transfers, was quoted:

This transfer of several units (数个单位) will inevitably have an impact on the overall combat effectiveness of the flotilla in the short term, but in terms of long-term development this reform is a milestone in ‘making the country stronger with elite soldiers’ (精兵强国)!<sup>95</sup>

According to the article, the flotilla’s Party committee had been preparing for the transfers since early 2016. The news article spoke to the unprecedented movement of crews and their families and was likely representative of many inter-fleet transfers that commenced in 2017.

This *People’s Navy* article on “below-the-neck” submarine transfers indicates that the moves compensated for the retirement of older submarines that were not, in fact, replaced with new-construction submarines. Based on the personnel named in the article, the Northern Theater Navy submarine flotilla in question is almost certainly the 2<sup>nd</sup> Submarine Flotilla in Qingdao which hosts only *Song* SS.<sup>96</sup> The article indicates that crews were being transferred along with their submarines (随艇转隶) in 2017. Based on a review of available commercial satellite imagery since 2017, two *Song* SS probably transferred from Qingdao’s 2<sup>nd</sup> Submarine Flotilla to the Southern Theater’s Xiachuan Island submarine base (52<sup>nd</sup> Submarine Flotilla) to replace *Ming* SS that were being retired.

Below is an accounting of apparent transfers since “below-the-neck” reforms began in 2017 among PLAN submarine flotillas according to submarine type.

***Ming* SS.** The PLAN decommissioned nine of its twelve remaining *Ming* SSs by early-2023. Two refurbished *Mings* were sold to the Bangladesh Navy in late-2016.<sup>97</sup> All *Ming* submarines had

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<sup>95</sup> Xiao, Hong, and Mao, “Thousands of Posts Show the True Qualities of Military Personnel,” p. 2.

<sup>96</sup> The commander named is Ding Yongwei (丁永伟) and the deputy commander is Sha Weiliang (沙卫良), both identified in several articles as leaders of the 2<sup>nd</sup> Submarine Flotilla. See, for example, 澎湃在深海的愛 [“Overwhelming Love in the Deep Sea”], 解放军报 [*PLA Daily*], 12 July 2019, [http://www.81.cn/jfjfbmap/content/2019-07/12/content\\_238123.htm](http://www.81.cn/jfjfbmap/content/2019-07/12/content_238123.htm). See also, 央视网 [CCTV], 大批新型装备服役 中国海军正在加速成长 [“A Large Amount of New Equipment in Service, China’s Navy is Accelerating Growth”], 新华网 [Xinhua Net], 29 December 2021, [http://www.xinhuanet.com/mil/2021-12/29/c\\_1211505902.htm](http://www.xinhuanet.com/mil/2021-12/29/c_1211505902.htm).

<sup>97</sup> Gurpreet S. Khurana, “China Delivers Submarines to Bangladesh: Imperatives, Intentions, and Implications,” Center for International Maritime Security, 6 December 2016, <https://cimsec.org/china-delivers-submarines-bangladesh-imperatives-intentions-implications/>.

departed Lushun by mid-2020 concurrent with the arrival of four additional *Yuan* SSPs at the base.<sup>98</sup> Only three *Ming* SS remained at the Xiachuan Island submarine base as of early-2023.<sup>99</sup> Some of these retired *Ming* submarines were seen in commercial satellite imagery at Yulin Naval Base beginning in 2017, apparently waiting to be scrapped at the Yulin Naval Base shipyard in 2021.<sup>100</sup> Trained submarine crews from the retired *Mings* were likely retrained to crew new-construction submarines.

***Kilo* SS.** Two older Russian-purchased *Kilo* SS (Project 877EKM) were retired in 2021 from the Xiangshan submarine base (42<sup>nd</sup> Submarine Flotilla).<sup>101</sup> The *Kilo* crews probably provided manning for new-construction *Yuan* SSPs or nuclear-powered submarines.

***Song* SS.** In 2017, two *Song* SS were likely transferred from Qingdao (2<sup>nd</sup> Submarine Flotilla) to Xiachuan Island (52<sup>nd</sup> Submarine Flotilla).<sup>102</sup> These *Song* SS replaced as many as five *Ming* SSs that were retired from Xiachuan Dao also in 2017. Four *Song* SS apparently remain at Yulin (32<sup>nd</sup> Submarine Flotilla); however, two of those *Song* SS have been noted in long-term maintenance in the adjacent shipyard.<sup>103</sup>

***Yuan* SSPs.** Since 2017, seven *Yuan* SSPs were added to the PLAN order of battle. As inter-fleet transfers likely began, the largest concentration of *Yuan* SSPs (ten submarines) was in the Eastern Theater at the Daxie Island submarine base (22<sup>nd</sup> Submarine Flotilla). Some of the ten Daxie Island *Yuan* crews and submarines probably transferred to Lushun (12<sup>th</sup> Submarine Flotilla) and Yulin (32<sup>nd</sup> Submarine Flotilla) in the Northern and Southern Theaters, respectively. The number of *Yuan* SSPs observed at Lushun submarine base doubled from three in 2017 to six by mid-2018.<sup>104</sup> A total of seven *Yuan* SSPs were noted at Lushun by late-2019 (Figure 8). This suggests a possible inter-fleet transfer of two to three *Yuan* from Daxie Island to Lushun even as each base received a share of the four new *Yuan* commissioned between 2017 and 2018.<sup>105</sup> Similarly, three *Yuan* SSPs appeared at Yulin submarine base in the Southern Theater in mid-2022 (Figure 9). This, again, suggests an interfleet transfer in combination with three new-construction *Yuans* added to the fleet between 2021 and 2022.<sup>106</sup> New-construction submarines probably restored the number of *Yuan* SSPs at Daxie Island to ten by late-2022 (Figure 10).

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<sup>98</sup> Google Earth Pro 7.3.6.9345, 25 February 2020, Lushun, China, 36.789N, 121.240E, Maxar Technologies 2023.

<sup>99</sup> Planet, SkySat, Image ID: 20230218\_061804\_ssc10\_u0001, 18 February 2023, Xiachuan Dao, China, 21.596N, 112.550E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com).

<sup>100</sup> Google Earth Pro 7.3.6.9345, 29 September 2021, Yulin, China, 18.228N, 109.551E, Maxar Technologies 2023.

<sup>101</sup> Office of the U.S. Secretary of Defense, *CMPR*, p. 53.

<sup>102</sup> Google Earth Pro 7.3.6.9345, 7 September 2019, Xiachuan Dao, China, 21.596N, 112.550E, CNES/Airbus 2023.

<sup>103</sup> Google Earth Pro 7.3.6.9345, 30 July 2022, 18 September 2022, and 22 December 2022, Yulin, China, 18.228N, 109.551E, Maxar Technologies 2023

<sup>104</sup> Google Earth Pro 7.3.6.9345, 2 February 2017 and 29 May 2018, Lushun, China, 36.789N, 121.240E, Maxar Technologies 2023.

<sup>105</sup> According to IHS Janes, *Yuan* pennant numbers 343 and 344 were commissioned in 2017 and boats 345 and 346 were commissioned in 2018. “Yuan (Type 039A/B/C/D) class (SSK)” (updated 29 July 2022), *Janes Fighting Ships* (updated 9 February 2023), accessed 23 March 2023, [www.janes.com](http://www.janes.com).

<sup>106</sup> According to IHS Janes, *Yuan* pennant number 347 was commissioned in 2021 and boats with pennant numbers 348 and 349 were commissioned in 2022. Janes, “Yuan (Type 039A/B/C/D) class (SSK),” *Fighting Ships*.





Figure 8. Seven *Yuan* SSPs at Lushun Submarine Base in 2019 (Google Earth/Maxar)<sup>107</sup>



Figure 9. Three *Yuan* SSPs at Yulin Submarine Base in 2022 (Google Earth/Maxar)<sup>108</sup>



Figure 10. Nine *Yuan* SSPs at Daxie Dao (Island) Submarine Base in 2022 (© 2023 Planet)<sup>109</sup>

<sup>107</sup> Google Earth Pro 7.3.6.9345, 30 December 2019, Lushun, China, 36.789N, 121.240E, Maxar Technologies 2023.

<sup>108</sup> Google Earth Pro 7.3.6.9345, 30 July 2022, Yulin, China, 18.228N, 109.551E, Maxar Technologies 2023.

<sup>109</sup> Planet, SkySat, Image ID: 20221223\_042436\_ssc16\_u0004, 23 December 2022, Daxie Dao, China, 29.898N, 121.968E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com).

**Han SSN and Xia SSBN.** The status of these submarines is unclear, but they are likely in a caretaker status or have been decommissioned awaiting dismantlement. Three remaining *Han* SSNs and one *Xia* SSBN, all commissioned in the 1980s, were in port Jianggezhuang as of early-2023 with few indications of recent movement or activity.<sup>110</sup> The majority of these submarines' crew members have probably transferred to new-construction *Shang* SSNs or *Jin* SSBNs. It is possible, but unlikely, that these older submarines are operational with a full crew compliment.

**Shang SSN.** As of 2017, two *Shang* SSNs were assigned to the Northern Theater Navy's 1<sup>st</sup> Submarine Base at Jianggezhuang and two were assigned to Southern Theater Navy's 2<sup>nd</sup> Submarine base in Yalong.<sup>111</sup> Between 2017 and 2018, two additional *Shang* SSNs joined the PLAN with both assigned to Jianggezhuang for a total of six *Shangs* in-service as of early-2023 (Figure 11).<sup>112</sup> A seventh *Shang* SSN was launched from the Huludao Shipyard in May 2022. An eighth *Shang* SSN was launched in January 2023. As of March 2023, these new submarines were still in Huludao being fitted out and probably fueling their nuclear reactors.<sup>113</sup> The two new *Shang* SSNs are probably not yet fully crewed and will probably be commissioned in 2024, homeported at Yalong. Trained submarine crew personnel for the two new in-service *Shang* SSNs and two pre-commission *Shang* SSNs were likely drawn from personnel made available from retired *Han* SSNs as well as conventional submarines.



Figure 11. *Shang* SSN at Jianggezhuang, February 2023 (© 2023 Airbus)<sup>114</sup>

<sup>110</sup> Airbus, Pleiades-Neo, Image ID: PNEO3\_202302140247308\_MS-FS\_ORT, 14 February 2023, Jianggezhuang, China, 36.112N, 120.576E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com).

<sup>111</sup> Google Earth Pro 7.3.6.9345, 10 December 2015, Yalong, China, 18.213N, 109.697E, and 10 September 2016, Jianggezhuang, China, 36.112N, 120.576E, Maxar Technologies 2023.

<sup>112</sup> Google Earth Pro 7.3.6.9345, 19 January 2021, Yalong, China, 18.213N, 109.697E, Maxar Technologies 2023.

<sup>113</sup> Christopher Biggers, "China Launches Second Possible Type 093B Hull," *Janes Defence News*, 01 February 2023, <https://www.janes.com/defence-news/news-detail/china-launches-second-possible-type-093b-hull>.

<sup>114</sup> Airbus, Pleiades-Neo, Image ID: PNEO3\_202302140247308\_MS-FS\_ORT, 14 February 2023, Jianggezhuang, China, 36.112N, 120.576E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com). 2 x additional *Han* SSNs were berthed on the west side of the harbor in mid-February 2023.

***Jin* SSBN.** Two *Jin* SSBNs have been commissioned since 2017 for a total six *Jin* SSBNs in the PLAN fleet as of 2023, all homeported at Yalong.<sup>115</sup> Trained personnel for these crews may have been drawn from the soon-to-be retired *Xia* SSBN homeported in Jianggezhuang. Additional experienced crew may have come from retired *Han* SSNs and conventional submarines.

Over the course of six years, the transfer of personnel and crews among twenty-seven submarines—twelve new and fifteen retired—combined with transfers of in-service submarines to ensure an equitable distribution of newly constructed submarines and crew talent across the force was likely among the largest organizational undertakings in the PLAN submarine force’s history. The constraints of the 2019-2022 COVID-19 pandemic and lockdowns likely made the transformation even more challenging for crew members and their families.

As indicated by 2017 *People’s Navy* reporting about *Song* SS and the imagery of 2017 *Yuan* SSP transfers to Lushun, there was almost certainly an initial surge of transfers that the PLAN claimed as “below-the-neck” reforms in 2017. It is possible that these transfers of submarines and personnel would have been necessary without the reforms. However, the PLAN submarine force probably also needed to publicly identify its contribution to the reform efforts that were roiling the rest of the PLA at the time. In the PLAA, the “below-the-neck” reforms initiated in 2017 were targeted for completion by 2020.<sup>116</sup> However, the PLAN submarine force apparently continued to transfer crews and submarines as new-construction submarines arrived to the force through 2022. Again, this seems to indicate that what were labeled “reforms” may have simply been a necessary transfer of personnel and submarines associated with a phase of new submarine construction and submarine retirements.

#### *Base Infrastructure and Anticipated Changes to Submarine Force Structure*

There are indications that the PLAN submarine force will continue to transfer personnel, crews, and submarines as new submarines enter the fleet at least through the late-2020s. Sources indicate that the PLAN may add five additional *Yuan* SSPs over the next several years.<sup>117</sup> The U.S. Navy projects no growth in the PLAN conventional submarine force, suggesting that an older submarine will be retired for every new conventional submarine that enters the fleet. However, publicly available U.S. Navy figures also suggest a marked increase in PLAN nuclear-powered submarines with two additional SSBNs and as many as seven SSNs joining the fleet by 2030.<sup>118</sup>

Infrastructure improvements at PLAN conventional submarine bases have accompanied the arrival of new submarines or transfer of in-service submarines since 2017. Observations of infrastructure improvements provide a leading indicator of impending changes in force structure and, potentially, future organizational changes in the PLAN submarine force.

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<sup>115</sup> “*Jin* Class (Type 094) (SSBN)” (updated 1 February 2022), *Janes Fighting Ships* (updated 19 January 2023), accessed 23 March 2023, [www.janes.com](http://www.janes.com).

<sup>116</sup> Blasko, “The Biggest Loser in the Chinese Military Reforms: The PLA Army,” p 358.

<sup>117</sup> Janes indicates five additional *Yuan* SSPs may be built, “*Yuan* (Type 039A/B/C/D) class (SSK)” (updated 29 July 2022), *Janes Fighting Ships* (updated 9 February 2023), accessed 23 March 2023, [www.janes.com](http://www.janes.com), the DoD CMPR similarly indicates a total of twenty-five *Yuan* will be built less the twenty accounted for in this report, Office of the U.S. Secretary of Defense, *CMPR*, p. 54.

<sup>118</sup> It is not clear whether U.S. Navy numbers of thirteen or fourteen total PLAN SSNs by 2030 include any older *Han* SSNs, which this report excludes from its 2023 count of seven PLAN SSNs, which are all *Shangs*. See U.S. Navy numbers in Ronald O’Rourke, *China Naval Modernization: Implications for U.S. Navy Capabilities*, CRS Report No. RL33153 (Washington, DC: Congressional Research Service, 2022), pp. 9-10, <https://crsreports.congress.gov/product/pdf/RL/RL33153>.

The most significant base infrastructure improvements that preceded 2017 interfleet transfers and the retirement of older submarines were at the Northern Theater Navy's Lushun Naval Base, home of the 12<sup>th</sup> Submarine Flotilla. Construction of new piers and floating docks was underway in 2016 as planning likely began for interfleet transfers of *Yuan* SSPs and *Yuan* crews (Figure 12).

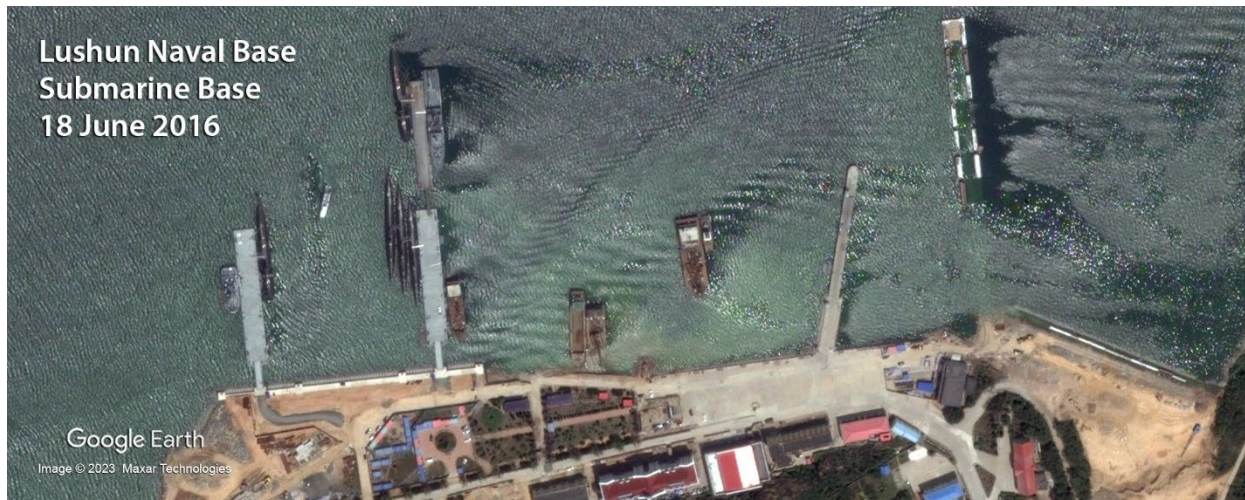


Figure 12. New Pier Construction at Lushun Submarine Base, 2016 (Google Earth/Maxar)<sup>119</sup>

New piers were in place at Lushun by early-2017 as construction began on a liquid oxygen storage facility.<sup>120</sup> Shore-based cryogenic production and storage of liquid oxygen known as LOX or LO<sup>2</sup> is used to fuel *Yuan* SSPs and their air independent propulsion (AIP) Stirling engines. Lushun's LOX facility was completed by early 2018 (Figure 13). An identical PLAN submarine LOX facility was constructed in 2010 near Daxie Island Submarine Base and identified on a liquified gas industry web site in 2016 (Figure 14).

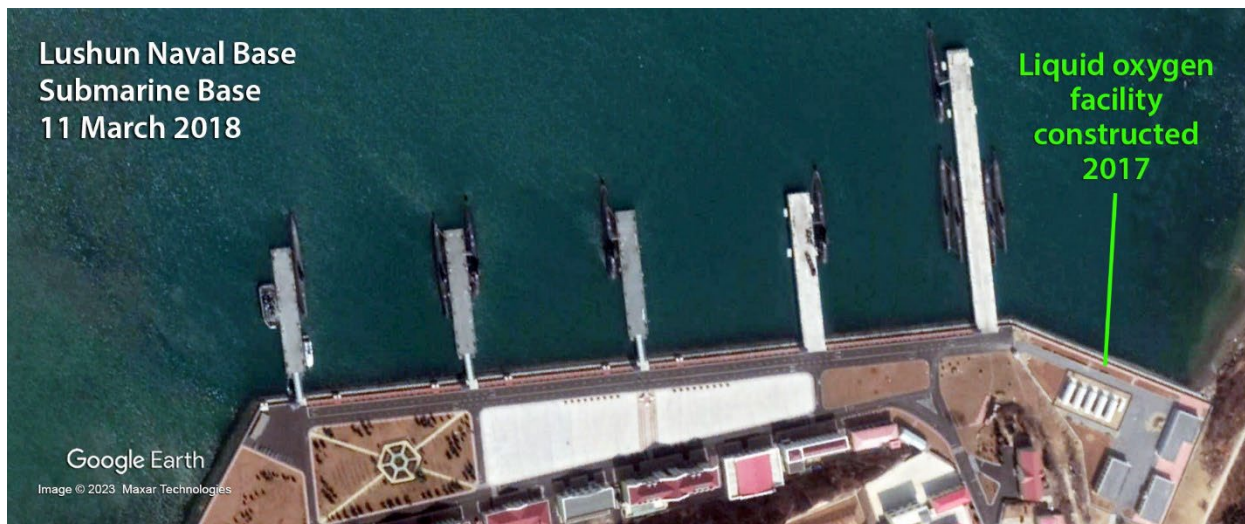


Figure 13. Lushun Submarine Base Liquid Oxygen Facility, 2018 (Google Earth/Maxar)<sup>121</sup>

<sup>119</sup> Google Earth Pro 7.3.6.9345, 18 June 2016, Lushun, China, 36.789N, 121.240E, Maxar Technologies 2023.

<sup>120</sup> Google Earth Pro 7.3.6.9345, 7 July 2017, Lushun, China, 36.789N, 121.240E, Maxar Technologies 2023.

<sup>121</sup> Google Earth Pro 7.3.6.9345, 11 March 2018, Lushun, China, 36.789N, 121.240E, Maxar Technologies 2023.



Figure 14. Daxie Dao (Island)/Ningbo Liquid Oxygen Facility (Google Earth/Maxar)<sup>122</sup>

A LOX facility has not been identified at Yulin Submarine Base which hosts only three *Yuan* SSPs since mid-2022. Currently, liquid oxygen for AIP submarines is apparently supplied by truck (Figure 15). If more *Yuan* SSPs are assigned to Yulin, a LOX facility may be constructed, possibly in Yulin's outer harbor, which has seen significant development over the past several years.

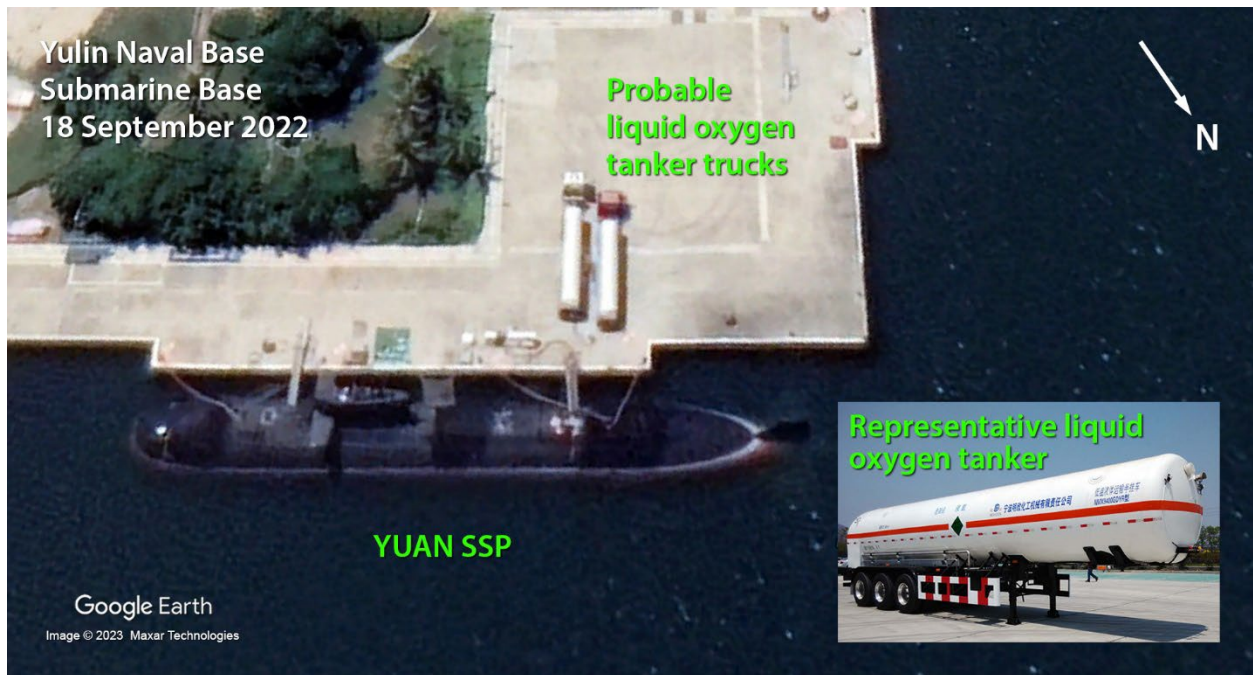


Figure 15. Probable Liquid Oxygen Trucks Resupplying *Yuan* SSP, Yulin Submarine Base (Google Earth/Maxar)<sup>123</sup>

<sup>122</sup> Google Earth Pro 7.3.6.9345, 19 May 2017, Ningbo, China, 29.890N, 121.941E, Maxar Technologies 2023 and photo by 宁海 [Ning Hai], 大型液氧液氮贮罐 [“Large-Scale Liquid Oxygen and Liquid Nitrogen Storage Tanks”], 液化天然气 [Liquefied Natural Gas Web], 30 June 2016, <http://www.cnlng.com/bencandy.php?fid=36&id=42944>.

<sup>123</sup> Google Earth Pro 7.3.6.9345, 18 September 2022, Yulin, China, 18.228N, 109.551E, Maxar Technologies 2023.

Infrastructure improvements at PLAN nuclear submarine bases began in 2021, likely in anticipation of the new *Shang* SSNs launched in 2022 and 2023 and the seven additional SSNs and SSBNs projected to arrive in the PLAN fleet through 2030. Observations of improvements under construction in 2023 at the PLAN's two nuclear submarine bases support those new submarine forecasts. There is also construction activity at Xiangshan Submarine Base that may portend a new nuclear submarine base in the Eastern Theater.

At the 1<sup>st</sup> Submarine Base at Jianggezhuang, two improved floating docks for submarine berthing were installed in mid-2021 (See Appendix, Jianggezhuang Submarine Base). As of early 2023, a new pier was also under construction on the west side of the harbor (Figure 16). The modest increase of one or two submarine berths at Jianggezhuang should be accompanied in the near future by the removal of the one *Xia* SSBN and three *Han* SSNs that have become permanent fixtures at the base. After construction of the new pier, there should be twelve total external berths at the base in addition to whatever internal pier space Jianggezhuang's underground submarine tunnel might provide. (See below for a discussion of nuclear submarine base tunnels.)



Figure 16. Pier Construction at Jianggezhuang Submarine Base, February 2023 (© 2023 Airbus)<sup>124</sup>

Construction on two new submarine piers at the 2<sup>nd</sup> Submarine Base in Yalong began in early 2022 and was nearing completion as of March 2023 (Figure 17). With the new piers, Yalong will have four additional submarine berths for a total of twelve external berths in addition to whatever can be accommodated inside Yalong's submarine tunnel.

<sup>124</sup> Airbus, Pleiades-Neo, Image ID: PNEO3\_202302140247308\_MS-FS\_ORI, 14 February 2023, Jianggezhuang, China, 36.112N, 120.576E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com).



Figure 17. Pier Construction at Yalong Submarine Base, February 2023 (© 2023 Airbus)<sup>125</sup>

In early 2023, construction began on a new pier at the western Xiangshan Submarine Base facility (Figure 18). This facility has been a PLAN shipyard for both submarines and surface ships. The eastern Xiangshan facility hosts the 42<sup>nd</sup> Submarine Flotilla and most of the PLAN's *Kilo* submarines. Interestingly, the western Xiangshan facility appears to have a legacy naval tunnel (Figure 19). It is unknown if the tunnel is serviceable, especially considering the quarry adjacent to the tunnel, which has been operational since 2010.



Figure 18. Pier Construction at Xiangshan (West) Submarine Base, March 2023 (Google/Maxar)<sup>126</sup>

<sup>125</sup> Airbus, Pleiades-Neo, Image ID: PHR\_PS\_20230330T0316\_TC\_Tile\_0\_0\_df94, 30 March 2023, Yalong, China, 18.211N, 109.688E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com).

<sup>126</sup> Google Earth Pro 7.3.6.9345, 27 May 2023, Xiangshan, China, 29.527N, 121.688E, Maxar Technologies 2023.

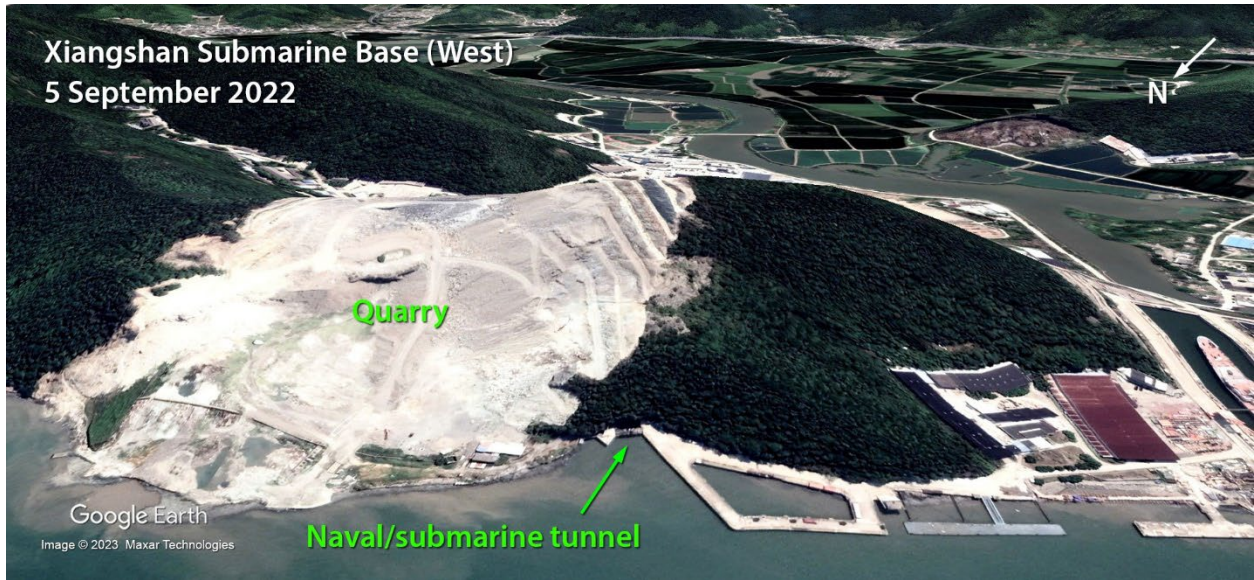


Figure 19. 3D View of Xiangshan Naval/Submarine Tunnel (Google/Maxar)<sup>127</sup>

The construction at the western part of the Xiangshan base may simply be an expansion of or improvement to the existing shipyard facility. Alternatively, the construction at Xiangshan may be the beginnings of a nuclear submarine base for the Eastern Theater Navy. This forward-leaning assessment is supported only by construction at Xiangshan concurrent with infrastructure improvements at the PLAN's other nuclear submarine bases, the PLAN's potential requirements for additional nuclear submarine facilities, and the lack of an Eastern Theater Navy nuclear submarine facility to date. The presence of the submarine/naval tunnel at Xiangshan adds circumstantial evidence to the speculation as submarine tunnels for nuclear submarine concealment are established features at the 1<sup>st</sup> and 2<sup>nd</sup> Submarine Bases (Figure 20).

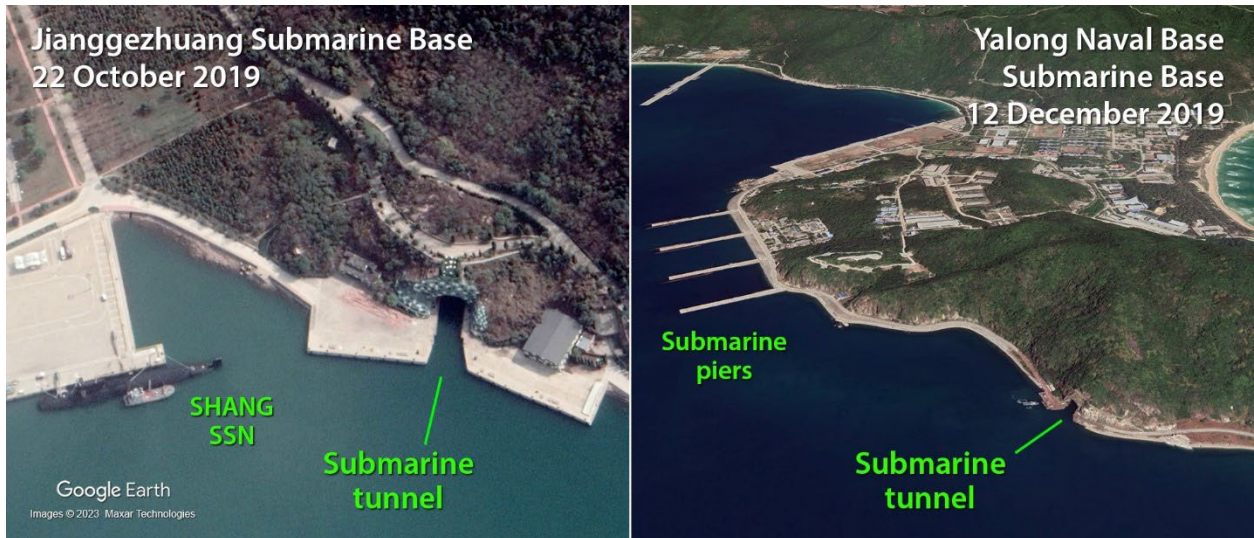


Figure 20. Submarine Tunnels at Jianggezhuang and Yalong Submarine Bases (Google Earth/Maxar)

<sup>127</sup> Google Earth Pro 7.3.6.9345, 5 September 2022, Xiangshan, China, 29.527N, 121.688E, Maxar Technologies 2023.



Monitoring naval base infrastructure development will provide leading indicators for what may be expected from PLAN submarine production in the coming years. The PLAN appears poised to commence a new round of submarine production that will necessitate continued transfers of in-service submarines and personnel to accommodate the new boats. A new conventional submarine construction facility on the Yangtze River, west of Wuhan, began production of *Yuan* SSPs for the PLAN and foreign customers in late-2020.<sup>128</sup> Huludao Naval Shipyard, which produces nuclear-powered submarines for the PLAN, was continuing the expansion of its facilities as of early 2023.<sup>129</sup> The roll-out of two new *Shang*-class SSNs from Huludao may represent the first step in a marked increase in the numbers of modern, nuclear-powered submarines in the PLAN inventory. The question becomes whether the PLAN submarine force will continue to decommission older submarines, perhaps *Song* SS, to crew the new nuclear boats or simply augment the numbers of submarine crew personnel to accommodate the increase.

## Conclusion

The PLAN submarine force has arguably undergone historical change since the 2015 “above-the-neck” reforms and 2017 “below-the-neck” reforms. Changes to command and control arrangements emphasizing joint coordination of undersea forces, the introduction of a dozen new submarines, and the retirement of even more has almost certainly resulted in impactful changes in the fleet. As the changes have settled out, they have likely resulted in an overall increase in PLAN submarine capabilities.

As outlined in this report, changes to operational command and control of undersea and other maritime forces have become clearer since the PLA’s joint operational command system was created as part of the “above-the-neck” and “below-the-neck” reforms. The theater “maritime operations sub-center,” similar to a U.S. Navy joint force maritime component commander (JFMCC) or maritime operations center (MOC) has emerged as the PLAN component under the operational theaters’ joint operations command center (T-JOCC). This command and control construct holds great promise for PLA joint operations but remains untested in a real-world contingency or conflict.

Control of PLA non-war military activities and operations abroad have apparently been consolidated under the CMC Joint Staff Department. However, the PLA’s operational theaters appear to be firmly in charge of wartime command and control and have directed operational forces thousands of miles from their respective theaters in what appears to be contingency planning exercises. How the PLA will grapple with operational control of combat forces including submarines in areas not directly related to a contingency on China’s periphery remains unclear.

New technologies have been the principal driver of change in the PLAN submarine force over the past several years, a trend that will likely continue well into the future. Other PLA services may have reshaped their formations and command organizations to address deficiencies in how they manage operations and how they fight wars. In contrast, technology appears to drive how the PLAN submarine force fights, which then necessitates commensurate changes in command and control.

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<sup>128</sup> H.I. Sutton, “China Increases Production of AIP Submarines with Massive New Shipyard,” *Naval News*, 16 February 2021, <https://www.navalnews.com/naval-news/2021/02/china-increases-production-of-aip-submarines-with-massive-new-shipyard/>; see also Google Earth Pro 7.3.6.9345, 28 January 2021, Wangpucun (Wuhan), China, 30.588N, 114.683E, Maxar Technologies 2023.

<sup>129</sup> H.I. Sutton, “Chinese Increasing Nuclear Submarine Shipyard Capacity,” *USNI News*, 12 October 2020, <https://news.usni.org/2020/10/12/chinese-increasing-nuclear-submarine-shipyard-capacity>, and H.I. Sutton, “Further Expansion of China’s Nuclear Submarine Shipyard,” *Covert Shores*, 5 January 2023, <http://www.hisutton.com/Chinese-Navy-Huludao-Expanding-202301.html>.

Granted, there may be a “chicken-egg” argument to be made as to whether technology begat changes in command and control or whether command and control requirements drove changes in technology. Regardless, the introduction of PLAN airborne surveillance and control aircraft like the KQ-200 and KJ-500, more capable ships for at-sea command and control like *Renhai* cruisers and aircraft carriers, new communications technologies, and uncrewed surface and underwater systems will likely continue to transform how the PLAN operates its submarines. Similarly, new longer-range weapons including submarine-launched anti-ship and land-attack missiles will drive future command and control arrangements for the PLAN submarine force.

Military services like the PLAA and PLAAF resized and reorganized in the name of reforms, making them more joint and, at least on paper, leaner and more combat effective. Although major PLAN submarine force command and unit reorganization did not occur, the PLAN sought to optimize its force structure and composition, retooling its force to enhance joint interoperability and combat effectiveness by shedding legacy platforms and gaining more capable, new-construction submarines. The addition of a dozen new submarines and the retirement of fifteen older generation submarines in the PLAN submarine force served the “below-the-neck” reform goal of increasing operational capability and capacity. The changes appear to meet Xi Jinping’s imperative for the PLAN to prepare to “fight and win wars.” Future interfleet transfers of submarines and crews will likely continue to be necessary given the projections for new nuclear and conventional submarines entering the force through 2030.

It is entirely possible, if not likely, that the changes observed in the PLAN submarine force over the past six years would have happened regardless of a PLA-wide campaign of reform and change. Submarine construction programs and lifecycles are measured in decades. The new submarines commissioned between 2017 and 2023 had been programmed to enter the fleet long before anyone had heard of “above-the-neck” or “below-the-neck” reforms. Similarly, many older PLAN submarines were beyond their prime and needed to be retired from the force regardless of a reform campaign.

In the final analysis, “below-the-neck” reform submarine transfers were fairly modest—two *Song* SS transferred from the Northern to Southern Theater, a couple of *Yuan* SSP transferred from the Eastern to Northern Theater, and as many as nine older *Ming* SS decommissioned from the Northern and Southern Theaters between 2017 and 2018. The timing of the “above-the-neck” and “below-the-neck” reforms conveniently allowed the PLAN to demonstrate to PLA leadership that the submarine force was ostensibly making sacrifices as part of the larger, collective reform effort across the PLA. However, the inter-fleet transfers to accommodate the commissioning and retirement of submarines continued beyond 2018 and will likely continue for the next several years.

Changes to PLAN submarine base infrastructure are likely leading indicators of future changes in submarine force structure. Infrastructure improvements at PLAN nuclear submarine bases outlined in this report indicate that the PLAN will continue to receive and incorporate new submarines over the next several years. The cycle of submarine and crew transfers observed in this report will likely continue through 2030 as new nuclear and AIP submarines enter the force and older *Ming*, *Song*, and *Kilo* submarines are retired.

## Appendix. PLAN Submarine Bases

This appendix provides information on the location and capacities of PLAN submarine bases. Numbers of berths are for single submarines. Bases with liquid oxygen facilities support air-independent propulsion (AIP) fueling for *Yuan* (Type 039A/B/C/D) SSPs.



Figure 21. PLAN Headquarters, Submarine Bases, and Flotillas

## NORTHERN THEATER NAVY

**PLA Navy Base:** Jianggezhuang, Shandong

**Coordinates:** 36.112N, 120.576E

**Number of Submarine Berths:** 10, soon 12

**Tunnel:** Yes    **Liquid Oxygen Facility:** No

**Unit:** 1<sup>st</sup> Submarine Base

**Military Unit Cover Designator:** 92330

**Submarines:** *Shang* (Type 093A/B) SSN



Figure 22. Jianggezhuang Submarine Base (Google Earth/Maxar) <sup>130</sup>

<sup>130</sup> Planet, SkySat, Image ID: 20230215\_024055\_ssc1\_u0001, 15 February 2023, Jianggezhuang, China, 36.112N, 120.576E, SkyWatch EarthCache, [www.skywatch.com](http://www.skywatch.com).

## NORTHERN THEATER NAVY

**PLA Navy Base:** Qingdao, Shandong

**Coordinates:** 36.094N, 120.312E

**Number of Submarine Berths:** 8

**Tunnel:** No    **Liquid Oxygen Facility:** No

**Unit:** 2<sup>nd</sup> Submarine Flotilla

**Military Unit Cover Designator:** 92196

**Submarines:** *Song* (Type 039G) SS

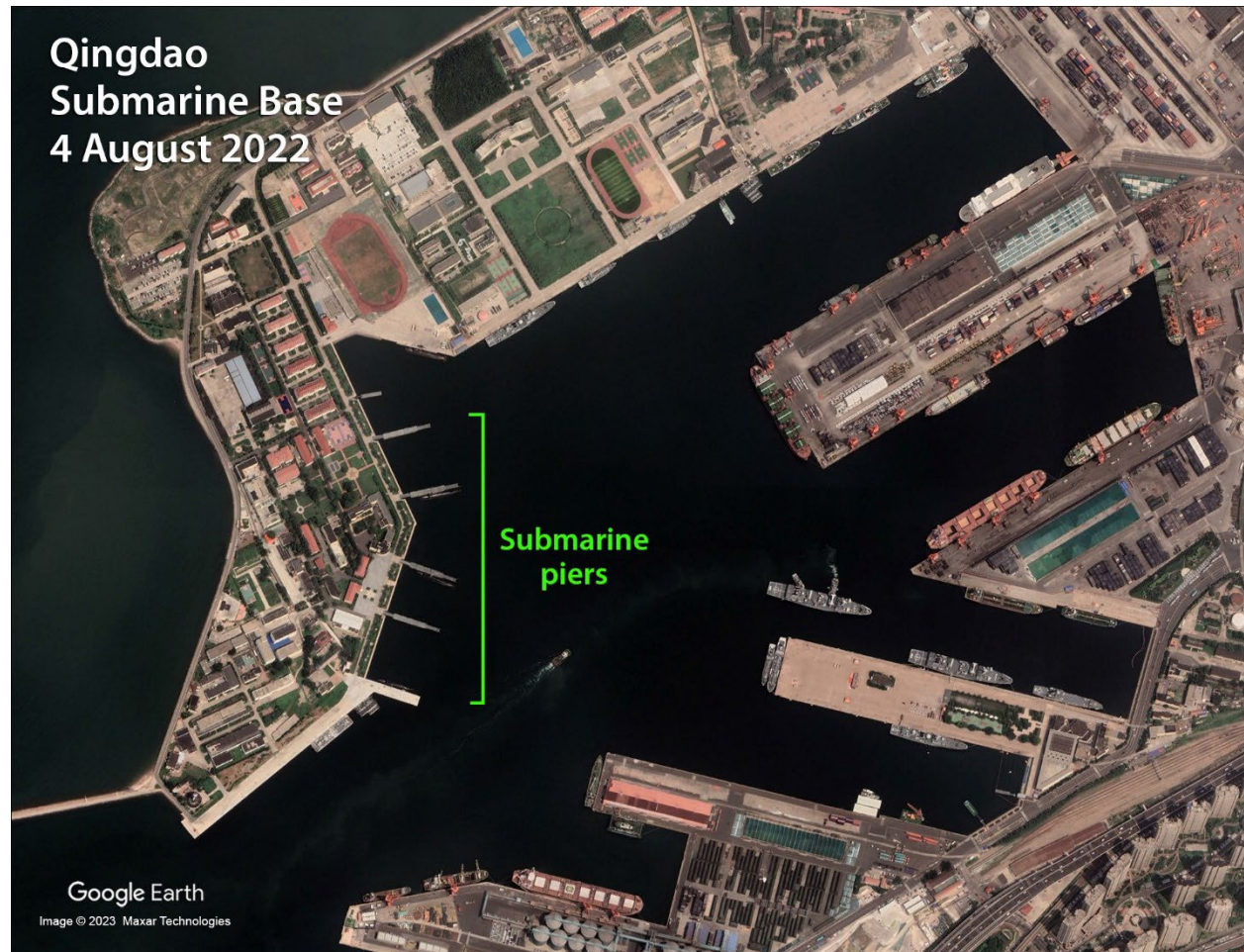


Figure 23. Qingdao Submarine Base (Google Earth/Maxar) <sup>131</sup>

<sup>131</sup> Google Earth Pro 7.3.6.9345, 4 August 2022, Qingdao, China, 36.094N, 120.312E, Maxar Technologies 2023.

## NORTHERN THEATER NAVY

**PLA Navy Base:** Lushun, Liaoning

**Coordinates:** 36.789N, 121.240E

**Number of Submarine Berths:** 12

**Tunnel:** No    **Liquid Oxygen Facility:** Yes

**Unit:** 12<sup>th</sup> Submarine Flotilla

**Military Unit Cover Designator:** 92763

**Submarines:** *Yuan* (Type 039A/B/C/D) SSP



Figure 24. Lushun Submarine Base (Google Earth/Maxar)<sup>132</sup>

<sup>132</sup> Google Earth Pro 7.3.6.9345, 24 July 2022, Lushun, China, 36.789N, 121.240E, Maxar Technologies 2023.

## NORTHERN THEATER NAVY

**PLA Navy Base:** Xiaoping Dao (Island), Liaoning

**Coordinates:** 38.820N, 121.492E

**Number of Submarine Berths:** 8

**Tunnel:** No    **Liquid Oxygen Facility:** No

**Unit:** 62<sup>nd</sup> Submarine Training Base

**Military Unit Cover Designator:** 92337

**Submarines:** *Qing* (Type 032) SSA



Figure 25. Xiaopingdao Submarine Base (Google Earth/CNES-Airbus)<sup>133</sup>

<sup>133</sup> Google Earth Pro 7.3.6.9345, 18 February 2022, Xiaopingdao, China, 38.820N, 121.492E, CNES/Airbus, 2023.

## EASTERN THEATER NAVY

**PLA Navy Base:** Daxie Dao (Island), Zhejiang

**Coordinates:** 29.898N, 121.968E

**Number of Submarine Berths:** 12

**Tunnel:** No    **Liquid Oxygen Facility:** Yes

**Unit:** 22<sup>nd</sup> Submarine Flotilla

**Military Unit Cover Designator:** 92858

**Submarines:** *Yuan* (Type 039A/B/C/D) SSP

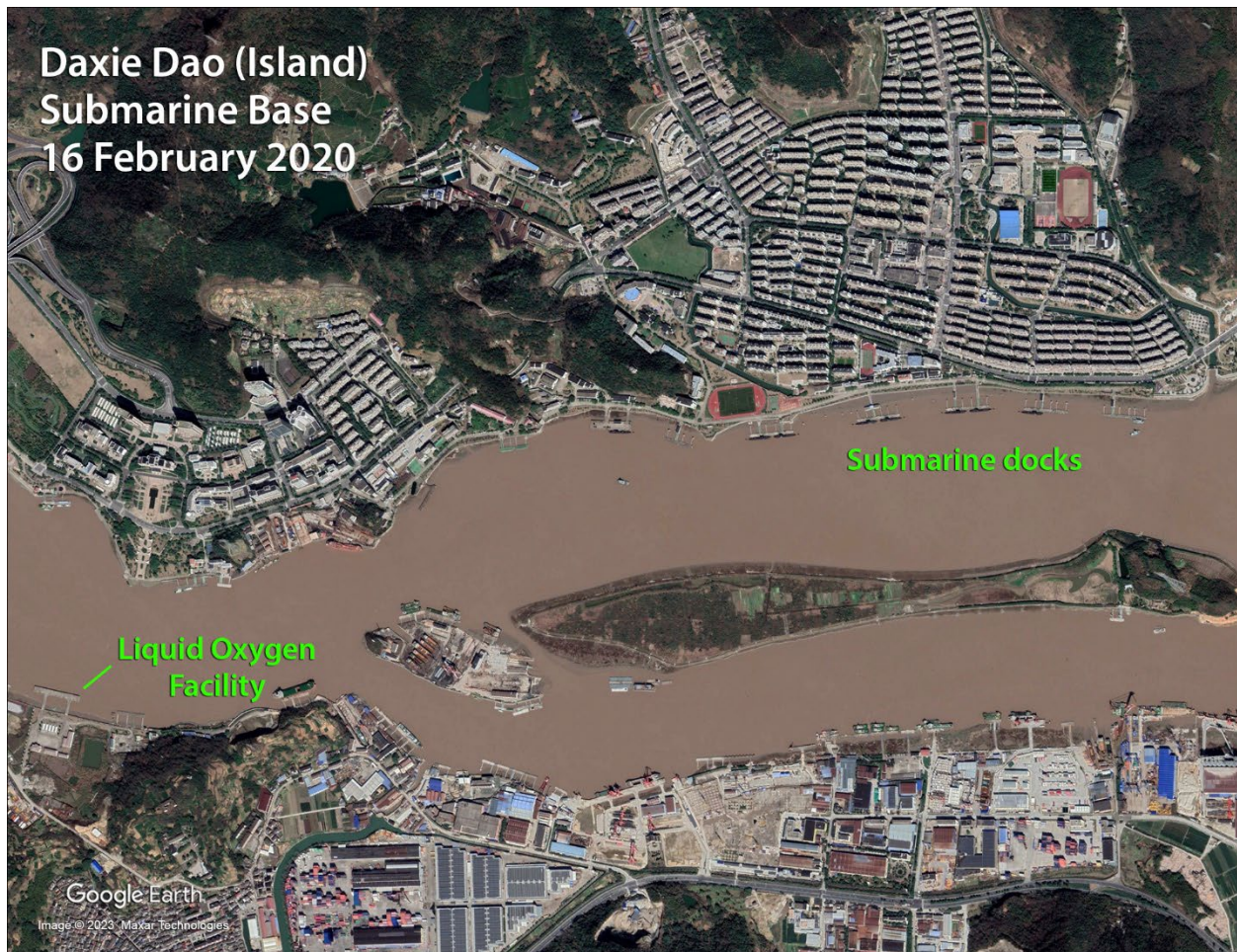
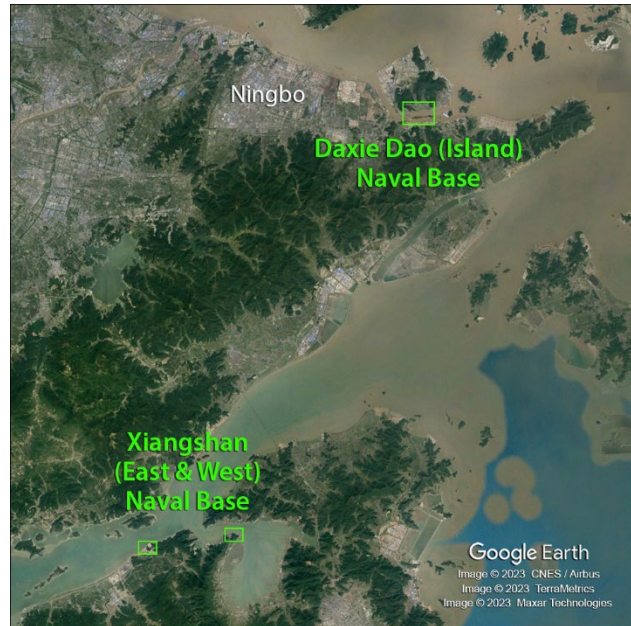


Figure 26. Daxie Dao Submarine Base (Google Earth/Maxar) <sup>134</sup>

<sup>134</sup> Google Earth Pro 7.3.6.9345, 16 February 2020, Daxie Dao, China, 29.898N, 121.968E, Maxar Technologies 2023.



**EASTERN THEATER NAVY**

**PLA Navy Base:** Xiangshan, Zhejiang

**Coordinates:** East: 29.537N, 121.770E  
West: 29.524N, 121.690E

**Number of Submarine Berths:** East:12  
West: 6

**Tunnel:** Yes    **Liquid Oxygen Facility:** No

**Unit:** 42<sup>nd</sup> Submarine Flotilla

**Military Unit Cover Designator:** 92815

**Submarines:** *Kilo* (Type 636) SS



Figure 27. Xiangshan Submarine Base (Google Earth/Maxar)<sup>135</sup>

<sup>135</sup> Google Earth Pro 7.3.6.9345, 1 October 2022, Xiangshan, China, 29.537N, 121.770E, Maxar Technologies 2023.

## SOUTHERN THEATER NAVY

**PLA Navy Base:** Yalong, Hainan

**Coordinates:** 18.213N, 109.697E

**Number of Submarine Berths:** 12

**Tunnel:** Yes    **Liquid Oxygen Facility:** No

**Unit:** 2<sup>nd</sup> Submarine Base

**Military Unit Cover Designator:** 92730

**Submarines:** *Shang* (Type 093A/B) SSN  
*Jin* (Type 094/A) SSBN

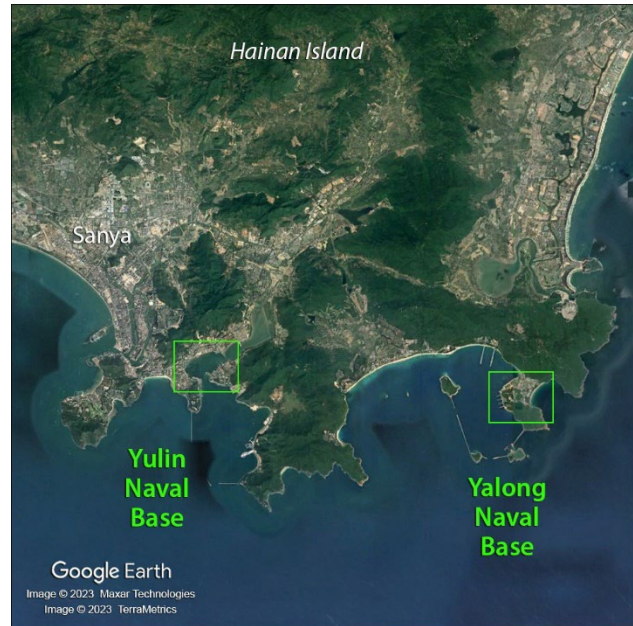


Figure 28. Yalong Submarine Base (Google Earth/Maxar) <sup>136</sup>

<sup>136</sup> Google Earth Pro 7.3.6.9345, 5 August 2022, Yalong, China, 18.214N 109.697E, Maxar Technologies 2023.

## SOUTHERN THEATER NAVY

**PLA Navy Base:** Yulin, Hainan

**Coordinates:** 18.226N, 109.549E

**Number of Submarine Berths:** 9

**Tunnel:** No    **Liquid Oxygen Facility:** No

**Unit:** 32<sup>nd</sup> Submarine Flotilla

**Military Unit Cover Designator:** 92474

**Submarines:** *Yuan* (Type 039A/B/C) SSP  
*Song* (Type 039G) SS  
*Kilo* (Type 636) SS

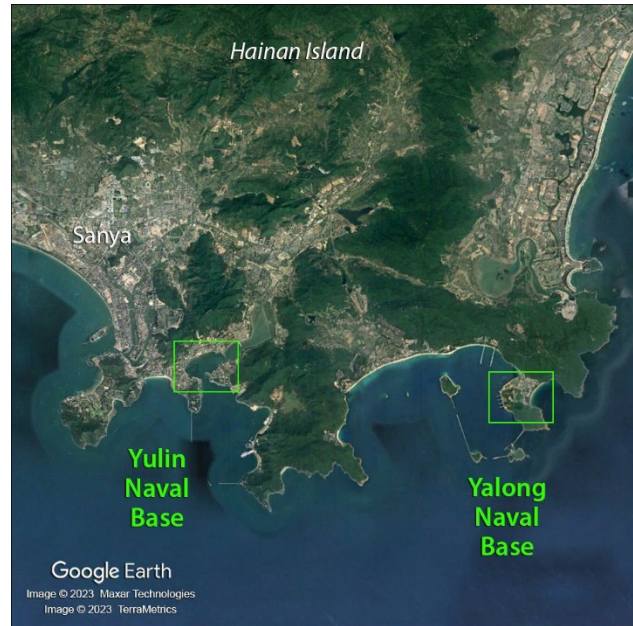


Figure 29. Yulin Submarine Base (Google Earth/Maxar) <sup>137</sup>

<sup>137</sup> Google Earth Pro 7.3.6.9345, 29 December 2022, Yulin, China, 18.226N, 109.549E, Maxar Technologies 2023.

## SOUTHERN THEATER NAVY

**PLA Navy Base:** Xiachuan Dao (Island),  
Guangdong

**Coordinates:** 21.596N, 112.550E

**Number of Submarine Berths:** 7

**Tunnel:** No    **Liquid Oxygen Facility:** No

**Unit:** 52<sup>nd</sup> Submarine Flotilla

**Military Unit Cover Designator:** 91024

**Submarines:** *Song* (Type 039G) SS  
*Ming* (Type 035) SS



Figure 30. Xiachuan Dao Submarine Base (Google Earth/CNES/Airbus)<sup>138</sup>

<sup>138</sup> Google Earth Pro 7.3.6.9345, 29 December 2021, Xiachuan Dao, China, 21.596N, 112.550E, CNES/Airbus 2023.

## About the Authors

J. Michael Dahm is a principal intelligence analyst at the MITRE Corporation where he focuses on Indo-Pacific security issues and challenges presented by the People's Republic of China across the spectrum of competition. Before joining MITRE, he was a senior researcher at the Johns Hopkins University Applied Physics Laboratory where he focused on foreign technology development. He has over 25 years of experience as a U.S. Navy intelligence officer with extensive experience in the Asia-Pacific region, including a tour as an Assistant U.S. Naval Attaché in Beijing, China, and Senior Naval Intelligence Officer for China at the Office of Naval Intelligence.

Alison Zhao is an Indo-Pacific advisor in the Commonwealth and Partner Engagement Directorate, Office of the Undersecretary of Defense for Intelligence and Security. Her prior career assignments include positions in the Defense Attaché Office, U.S. Embassy Beijing; the Joint Staff; and U.S. Forces Korea. She holds a M.A. in National Security and Strategic Studies from the U.S. Naval War College and a B.A. in International Relations and East Asian Studies from Johns Hopkins University.

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## Sources and Methods

Submarine order-of-battle numbers and disposition contained in this report will likely change over time. Findings in this report include analysis of commercial satellite imagery through March 2023.

This report fuses a variety of publicly and commercially available sources to gain detailed insights into often complex military activity and capabilities. Google Earth images are attributed to the commercial satellite provider and published under the Google Earth terms of service.<sup>139</sup> The report features commercial satellite imagery from Planet Labs PBC. High-resolution satellite imagery from Planet's SkySat constellation (ground sample distance (GSD) ~0.5 meters) was purchased by the authors through SkyWatch Space Applications Inc. The report also features commercial satellite imagery from Airbus Intelligence. Images from Airbus' Pleiades constellation (GSD ~0.5 meters) and Pleiades Neo constellation (GSD ~0.3 meters) were also purchased by the authors through SkyWatch.<sup>140</sup> The SkyWatch team's advice and assistance in accessing archived imagery used in this report was greatly appreciated. The authors are responsible for all annotations of satellite images in this report. Planet and Airbus retain copyrights to underlying SkySat and Pleiades-series images respectively. Other than Google Earth derived images, satellite images published in this report should not be reproduced without the expressed permission of Planet or Airbus.

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<sup>139</sup> "General Guidelines," Google Maps & Google Earth, [https://www.google.com/intl/en-GB\\_ALL/permissions/geoguidelines/](https://www.google.com/intl/en-GB_ALL/permissions/geoguidelines/).

<sup>140</sup> SkyWatch, <https://www.skywatch.com/>.