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China Maritime Report No. 25: More Chinese Ferry Tales: China's Use of Civilian Shipping in Military Activities, 2021-2022

J. Michael Dahm

中国海事研究所
China Maritime Studies Institute

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More Chinese Ferry Tales

China's Use of Civilian Shipping in Military Activities, 2021-2022

J. Michael Dahm

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

Summary
This report provides a comprehensive assessment of Chinese civilian shipping support to the People's Liberation Army (PLA), examining civil maritime-military activities from October 2021 through September 2022. As of 2022, the PLA and its reserve civilian merchant fleet are still probably unable to provide significant amphibious landing capabilities or the maritime logistics in austere or challenging environments necessary to support a major cross-strait invasion of Taiwan. However, large volume lift exercises conducted in 2022 suggest that the PLA has made significant progress in the use of civilian vessels for the large-scale lift of PLA troops and equipment into undefended ports, a capability that may be leveraged in a military assault on Taiwan. This report also discusses other civil maritime-military activities not previously observed, including the use of civilian vessels and infrastructure to conceal PLA troop movements, operations from austere ports, use of ocean-going vessels to transport PLA forces along inland waterways, and logistics support for China's South China Sea outposts.

Introduction
This report is a follow-on to China Maritime Report No. 16, which assessed PLA use of civilian shipping for logistics over-the-shore (LOTS) and amphibious landings in 2020 and 2021.[1] Like its predecessor, this report analyzes commercially available ship tracking data, satellite imagery, media reporting, and other open-source material to assess the capabilities of PLA logistics troops and supporting civilian ships, especially roll-on/roll-off (RO-RO) ferries. Unlike the earlier study that focused on major amphibious exercises, this report provides a comprehensive examination of all Chinese civil maritime-military events over an entire year.

Examining Chinese civil maritime-military events over time offers several advantages. It provides a greater understanding of the diversity of civil maritime-military events and how they may be prioritized. Foreign observers tend to focus on a Taiwan contingency, but the PLA is preparing to use—indeed, is already using—civilian shipping for other missions that merit attention. Even in the case of a Taiwan contingency, civilian ships may not be tasked only with LOTS. A comprehensive review of annual training sheds light on these other possible missions. Lastly, this approach offers analysis of training patterns over the course of a full year and lays the foundation for future studies of Chinese civil maritime-military training activities over multiple years.

This report examines thirty-eight civil maritime-military events that occurred between October 2021 and September 2022. A detailed analysis of these events reveals the focus of PLA training with civilian RO-RO vessels was moving ground forces from port-to-port. During the period under consideration, the PLA also used civilian vessels to train for beach landings. Those landings featured an updated version of the PLA floating causeway system for over-the-shore logistics discussed in China Maritime Report No. 16. But these landing events, which began in May and culminated in a September amphibious landing exercise, appeared to have modest aims and did not stress exercise participants with realistic combat conditions. Despite some increase in scale and complexity compared to the 2021 capstone landing exercise, the 2022 exercise strongly suggests that the PLA remains limited in its ability to employ civilian RO-RO ferries as part of a major beach assault against Taiwan. However, 2022 events overall do indicate that China's civil maritime industry has significantly advanced core capabilities for the large-scale lift of PLA troops and equipment into undefended, captured ports, capabilities that may be leveraged in a cross-strait invasion of Taiwan.

[1] J. Michael Dahm, "Chinese Ferry Tales: The PLA's Use of Civilian Shipping in Support of Over-the-Shore Logistics," China Maritime Report No. 16, China Maritime Studies Institute, November 2021, https://digital-commons.usnwc.edu/cmsi-maritime-reports/16.

Other findings include:

- An April 2022 event demonstrated the coordinated use of ten smaller RO-RO ferries probably to deploy a large PLA formation of vehicles. (See pages 7-8)
- In November 2021 and September 2022, large, ocean-going RO-RO ferries moved what were probably PLA units up the Yangtze River to the inland port of Nanjing. (See pages 8-10)
- An August 2022 event revealed how the PLA would likely use port infrastructure, including large warehouses, to camouflage and conceal military movements from civilian ports via civilian shipping. (See pages 10-12)
- In several events, civilian RO-RO ships operated from relatively austere ports without the use of tugboats or substantial port infrastructure to load and unload military equipment. (See pages 12-13)
- The PLA demonstrated significant increases in the volume of civil maritime-generated lift compared to observations of activity in 2020-2021.
    - From July-August 2022, twelve RO-RO ferries and cargo ships conducted 82 transits between eleven Chinese ports in a five-week-long large volume lift exercise. The exercise may have transported more than 8,500 military vehicles and 58,000 troops, probably equivalent to a group army (six PLA Army (PLAA) combined arms brigades plus six supporting brigades). (See pages 14-27)
    - The July-August 2022 event and a September event appeared to focus on moving non-amphibious, heavy combined arms units, elements that would likely constitute follow-on, second echelon forces in a cross-strait invasion of Taiwan. (See pages 28-31)
- The PLA exercised an improved floating causeway system, used by RO-RO ships to deploy forces directly into a beach landing area. The new modular system extends 2,130 feet (650 meters) from the shore, 40 percent farther than the causeway observed in 2021 training. (See pages 32-34)
- An amphibious landing capstone exercise in September 2022 was marginally more complex than a similar landing exercise observed in September 2021. (See pages 36-44)
    - Compared to the eight ships involved in the 2021 exercise, ten ships participated in the 2022 landing exercise and, like the 2021 exercise, were integrated with PLA Navy (PLAN) amphibious ships in offshore landing evolutions.
    - Four RO-RO ferries conducted offshore launches of amphibious armored vehicles or assault boats, double the number of RO-RO ferries that deployed forces at sea in 2021.
- Two RO-RO ferries and two general cargo ships provided military logistics support to PLA island outposts in the South China Sea. (See pages 45-47)

This report comprises five sections and two appendices. Section one provides a brief overview of events observed during the 2021-2022 time period. Sections two through five present detailed analysis of the four main categories of events observed: inter- / intra-theater mobility, large volume lift exercises, amphibious landings and LOTS, and South China Sea logistics support. The report concludes with Appendix A, offering a listing and details of Chinese merchant ships observed participating in civil-maritime activity, and Appendix B, describing Chinese ports assessed to have supported civil-military activity.

Section 1. 2021-2022 Civil Maritime-Military Events

A total of thirty-eight civil maritime-military events were observed during the reporting period, with twelve categorized as "significant," involving multiple ships in coordinated activities. Three major exercises also occurred at the end of the reporting period (see Figure 1).

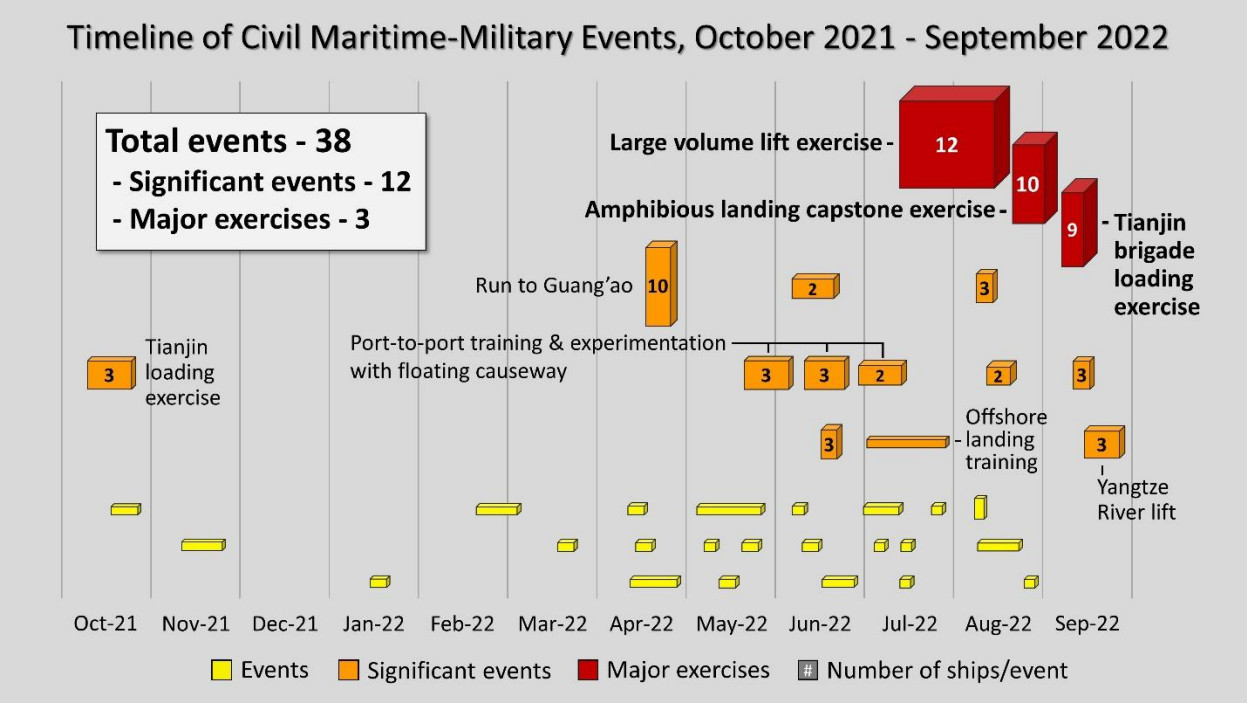

Figure 1. Timeline of Civil Maritime-Military Events, October 2021-September 2022

Civil maritime support to military exercises appears to follow a pattern consistent with the PLA's annual training cycle. Coordinated training events became increasingly numerous and complex through the spring and summer, culminating in a set of large-scale exercises in the late summer and early fall. 2022's large volume lift exercise, the amphibious landing capstone exercise, and the Tianjin brigade loading exercise probably constituted these culminating exercises for the PLA and are examined in detail in this report. Single ship events—most moving PLA units up and down the Chinese coast—occurred throughout the year.

Analytic Assumptions. This report assumes RO-RO ferry activity that occurred away from normal ferry routes was probably military-related activity. In the absence of satellite imagery or other confirmation, it is certainly possible that some off-ferry route activity was commercial activity, but that has proven unlikely. In each case where commercial satellite imagery was available, the imagery confirmed military activity. In no case examined between 2020 and 2022 has satellite imagery revealed RO-RO ferries conducting commercial activity when off their normal routes. In contrast, RO-RO vehicle carriers and general cargo ships observed supporting civil maritime-military activity do not always have established voyage routes and have, in fact, been observed conducting commercial activity before or after military events. In the absence of imagery confirmation, activity by these types of ships is only assumed to be military-related if it occurs in conjunction with other probable civil maritime-military activity such as off-route RO-RO ferry events.

Thirty-six Chinese civilian ships spent a combined total of 744 ship-days in support of PLA activities from October 2021 through September 2022 (see Figure 2).

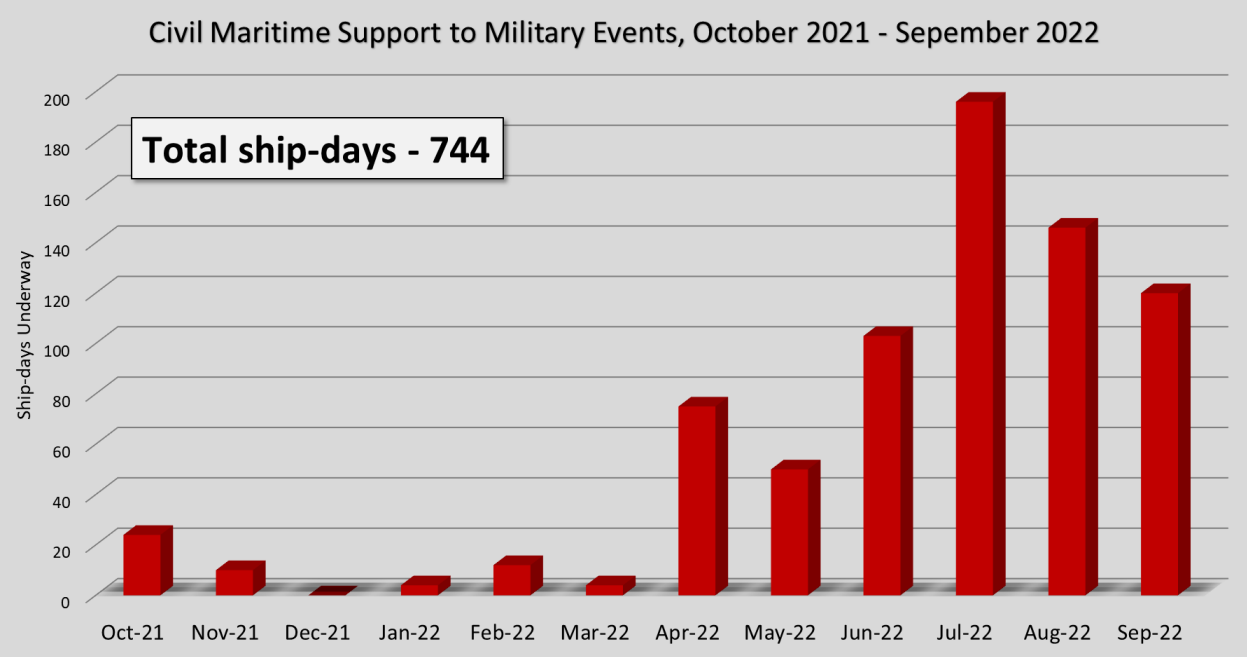

Figure 2. Civil Maritime Support to Military Events by Month, October 2021-September 2022 [2]

The thirty-six Chinese-owned and flagged merchant ships observed supporting military events in 2022 were more than double the number of civilian ships observed participating in military activities in either 2020 or 2021. Large, ocean-going RO-RO ferries built to Chinese national defense standards provided most of the military lift capacity in civil maritime-military events in 2022.[3] Eighteen of these large RO-RO ferries were involved in multiple events throughout the year, representing 58 percent of the available Chinese fleet of thirty-one large, ocean-going RO-RO ferries.[4] A maximum of eight RO-RO ferries—26 percent of the Chinese fleet of large RO-RO ferries—supported military activities at any one time.

The PLA may be exploiting an opportunity to charter and train with underemployed ships. It is possible that the ongoing COVID-19 pandemic has made RO-RO ferries more available as travel restrictions, especially for routine travel and tourism in China, have reduced demand for ferry

[2] "Total ship-days" equals the total number of days for all ships actively supporting military events to include transit time to and from homeports or the ships' last likely commercial port call. "Ship-days" also includes time spent in port during on-going military activities (i.e., loading/unloading or in-port training). The numbers in Figure 2 do not include operating days for the semi-submersible barge SAN HAN GONG 8, which was a fixture in Dacheng Bay for months working with the PLA's floating causeway (105 days); nor do they include days underway for tugboats supporting the barge or other activities. Numbers do not include days in-port Tianjin for the XINHAISHENG 8, training with its loading ramp (34 days). Numbers also do not include South China Sea logistics support provided year-round by the general cargo ships CHANG XIONG (365 days) and CHANG ZAN (43 days).

[3] RO-RO ships in China's civilian "strategic projection support ship fleet" were built to national defense standards beginning in the early 2010s. See Conor M. Kennedy, "Civil Transport in PLA Power Projection," China Maritime Report No. 4, China Maritime Studies Institute, December 2019, 8-9, https://digital-commons.usnwc.edu/cmsi-maritime-reports/4.

[4] Available RO-RO ferry fleet excludes SHENG SHENG 1, likely at the end of its service life, and ZHONG HUA FU QIANG, which had not returned to service by late 2022 following a 2021 fire in its vehicle bay.

services. That appeared to be the case with three RO-RO passenger cruise ships that normally engage in "eco-tourism" in the South China Sea. According to AIS data, those cruise ships sat idle unless they were supporting PLA requirements.

Civilian ships observed supporting military activities during the reporting period fall into three ownership categories: 1) RO-RO ferries owned by the publicly traded Bohai Ferry Group corporation, 2) a single cargo ship owned by the privately held Qingdao Old Captain Shipping Company (FU YUN 828), and 3) those ships that are ultimately owned by large Chinese state-owned enterprises (SOEs) such as the China Ocean Shipping Company (COSCO) or China Merchants Group. Ships that participated in 2022 civil maritime-military events are listed in Table 1. Appendix A lists ships owned, operated, or managed by companies observed participating in PLA activities since 2020 and provides additional details and specifications for each ship.

Table 1. Civilian Ships Observed Supporting Military Events, October 2021-September 2022

Ship Name	Name (Chinese)	Ship Name	Name (Chinese)
Bohai Gulf RO-RO Ferries			
BO HAI BAO ZHU	渤海宝珠	BO HAI ZUAN ZHU	渤海钻珠
BO HAI CUI ZHU	渤海翠珠	SHENG SHENG 2	生生 2
BO HAI HENG TONG	渤海恒通	ZHONG HUA FU XING	中华复兴
BO HAI JIN ZHU	渤海金珠	CHANG SHAN DAO	长山岛
BO HAI JING ZHU	渤海晶珠	HAI YANG DAO	海洋岛
BO HAI MA ZHU	渤海玛珠	JI LONG DAO	吉龙岛
BO HAI YU ZHU	渤海玉珠	LONG XING DAO	龙兴岛
BO HAI ZHEN ZHU	渤海珍珠		
Qiongzhou Strait (Hainan Island) RO-RO Ferries			
HAI TANG WAN	海棠湾	SHUANG TAI 29	双泰 29
LI MU LING	黎母岭	WU ZHI SHAN	五指山
SHUANG TAI 26	双泰 26	YANG FAN HAI AN	扬帆海安
SHUANG TAI 27	双泰 27	ZI JING SHI YI HAO	紫荆十一号
SHUANG TAI 28	双泰 28	ZI JING SHI WU HAO	紫荆十五号
Vehicle Carriers and RO-RO Passenger Cruise Ships			
CHANG DA LONG	长达隆	QI ZI WAN	棋子湾
CHANG LE GONG ZHU	长乐公主	NAN HAI ZHI MENG	南海之梦
DA FENG GANG LI MING HAO	大丰港黎明号		
General Cargo Ships and Barges			
FU YUN 828	福运 828	SAN HANG GONG 8	三航工 8
CHANG XIONG	长(長)富	SHENG TAI	盛泰
CHANG ZAN	长赞	XINHAISHENG 8	新海升 8

Between October 2021 and September 2022, thirty-seven ports and terminals were used by civilian ships to support military activities (see Figure 3). Appendix B provides additional details about these ports and terminals, including coordinates and information about co-located facilities and port infrastructure.

Figure 3. Civil Maritime-Military Ports and Terminals, 2021-2022

Section 2. Inter- / Intra-Theater Mobility

Of the 38 civil maritime-military events noted in this report, 25 appear to be inter- or intra-theater mobility events, i.e., simply moving PLA troops, equipment, and vehicles from one port to another with little apparent tactical military imperative. These include short-haul lifts within the confines of the Bohai Gulf to long-haul lifts moving troops and materiel hundreds of miles up and down the Chinese coast. Several of these otherwise minor events are notable and are described in this section. They include a one-way lift involving ten smaller RO-RO ferries; two events in which civilian ships traveled 200 nautical miles up the Yangtze River, probably to deliver military vehicles; a cross-Bohai Gulf lift event that revealed camouflage, denial, and deception techniques; and an example of tactical operations from an austere port.

Additional military mobility events also likely took place during the reporting period in which PLA units moved via normal ferry routes across the Bohai Gulf or across the Qiongzhou Strait (between the Chinese mainland and Hainan Island). Such military lifts that do not deviate from established ferry routes are essentially undetectable from an examination of ship AIS data. Occasionally, a PLA video will show a military transportation event between civilian ferry terminals. This was the case in an August 2022 video that showed elements of the PLA 74th Group Army moving by train from the Xuwen ferry terminal to Hainan Island and returning via the ferry terminal at Haikou New Seaport.[5]

One-Way Lift Exercise—The Run to Guang'ao

Activity: From 24-28 April 2022, ten RO-RO ferries probably participated in a lift of military vehicles and personnel between the Haikou New Seaport (Hainan) and Guang'ao port (Guangdong), approximately 425 nautical miles (787 kilometers) to the east (See Table 2 and Figure 4). These ten ferries normally provide service across the Qiongzhou Strait, which is 10-15 nautical miles wide. They are significantly smaller than the ocean-going RO-RO ferries that transit the Bohai Gulf. Each ferry involved in this exercise can carry a mix of 45-50 civilian cars and trucks or an assessed combination of as many as 30 tanks, armored vehicles, trucks, and tactical vehicles.

Table 2. Run to Guang'ao, 24-28 April 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
LI MU LING	黎母岭	SHUANG TAI 26	双泰 26
SHUANG TAI 27	双泰 27	ZI JING SHI WU HAO	紫荆十五号
SHUANG TAI 29	双泰 29	HAI TANG WAN	海棠湾
YANG FAN HAI AN	扬帆海安	SHUANG TAI 28	双泰 28
ZI JING SHI YI HAO	紫荆十一号	WU ZHI SHAN	五指山
Ports			
Haikou New Seaport	海口市新海港	Guang'ao Port	广澳港

According to medium-resolution commercial satellite imagery and AIS data, all ten RO-RO ferries appear to have staged at Haikou New Seaport by the morning of 23 April 2022.[6] From 24-25 April, the ferries staggered their departures and began making their way east up the Chinese coast to

[5] "硬核投送!" [Hardcore Delivery!],央视军事 [CCTV Military], August 15, 2022, https://www.youtube.com/watch?v=nCsOPaFBcDs

[6] Planet, PlanetScope, Image ID: 20220423_030541_01_240a, April 23, 2022, Haikou, China, 20.056N, 110.148E, SkyWatch EarthCache, www.skywatch.com.

Guang'ao. Each ferry called in Guang'ao one-at-a-time, starting with the LI MU LING at approximately 0400 local time, 26 April, and ending with the WU ZHI SHAN at approximately 1300 local, 27 April. Each ferry apparently utilized the single RO-RO ramp at the container port and docked for two to three hours according to AIS data. The ships had returned to their normal ferry routes across the Qiongzhou Strait by 28 April.[7]

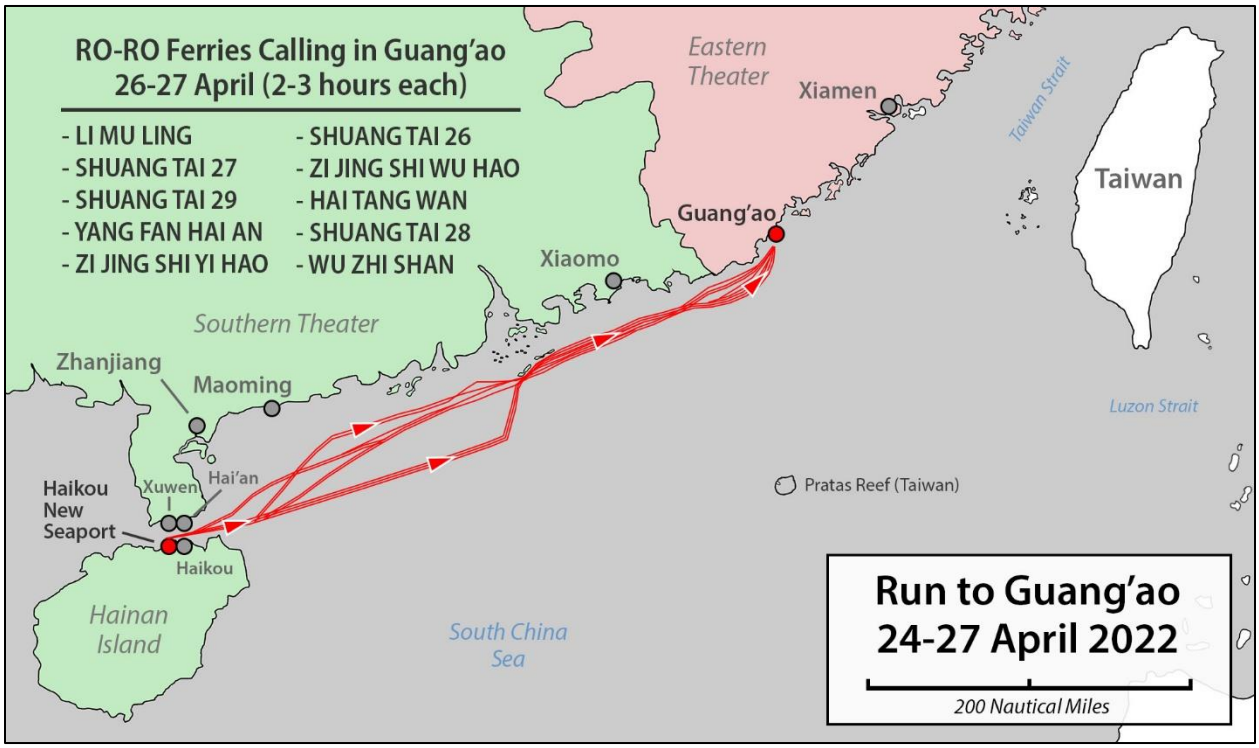

Figure 4. Run to Guang'ao, Guangdong, 24-27 April 2022

Assessment: This event demonstrates how smaller RO-RO ferries might be coordinated to move large PLA formations within China or, potentially, from a Chinese port into a captured Taiwan port. Taking ten ferries and out of service for several days to move civilian vehicles makes little business sense and probably indicates a movement of military vehicles. However, commercial satellite imagery was not available to verify this assessment. A large vehicles carrier would have been better suited to a one-way lift of vehicles for commercial purposes. These ten RO-RO ships had the potential to as many as 300 military vehicles—the equivalent of two heavy or three medium combined arms battalions—including trucks, tanks, and other armored vehicles.

Inland Waterway Operations

Activity: In November 2021 and again in September 2022, civilian ships including three large, ocean-going RO-RO ferries and one general cargo ship probably delivered military vehicles and personnel 200 nautical miles (370 kilometers) up the Yangtze River to the inland port of Nanjing (See Tables 3-4 and Figure 5Figure 5). Both Xiamen (Fujian) and Lianyungang (Jiangsu), the originating civilian ports for the respective November 2021 and September 2022 lifts, are known

[7] AIS position data: LI MU LING (MMSI 413523190), SHUANG TAI 27 (MMSI 413233620), SHUANG TAI 29 (MMSI), YANG FAN HAI AN (MMSI 413233650), ZI JING SHI YI HAO (MMSI 413233370), SHUANG TAI 26 (MMSI 413233590), ZI JING SHI WU HAO (MMSI 413232480), HAI TANG WAN (MMSI 413523980), SHUANG TAI 28 (MMSI 413233240), WU ZHI SHAN (MMSI 413523180), April 23-28, 2022, www.marinetraffic.com.

PLA embarkation ports. In both events, the ships stopped at the Nanjing Jiangsheng Automobile Terminal (南京港江盛汽车码头), 18 nautical miles (33 kilometers) northeast of the Nanjing city center.[8]

Table 3. Yangtze River Lift, 13-23 November 2021

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
SHENG SHENG 2	生生 2		
Ports			
Xiamen Cruise Terminal	厦门邮轮码头	Nanjing Port	南京港

Table 4. Yangtze River Lift, 22-28 September 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
BO HAI CUI ZHU	渤海翠珠	BO HAI JING ZHU	渤海晶珠
General Cargo Ships			
CHANG ZAN	长赞		
Ports			
Lianyungang Port	连云港港	Nanjing Port	南京港

Assessment: These events are the first observed use of large, ocean-going RO-RO ferries to transport vehicles or cargo to inland Chinese ports. Commercial satellite imagery was not available to confirm the assessment that this was a delivery of military equipment. However, the ports and ships involved as well as the patterns observed are consistent with other civil maritime-military activity between coastal ports. China has almost 60,000 nautical miles (110,000 kilometers) of navigable inland waterways managed by China's Ministry of Transport.[9] Civilian ships, including river vehicle carriers purpose-built to operate in shallower waters, could be used to deploy or reposition military equipment and troops via inland waterways. This may be a particularly significant capability if roads, bridges, and tunnels in China were damaged and unusable by military forces during a conflict or when responding to a natural disaster. Further research is required to fully understand the PLA's use of inland waterways to support military logistics and other operations.

[8] AIS position data: SHENG SHENG 2 (MMSI 413328380), November 16-20, 2021; BO HAI CUI ZHU (MMSI 414096000), BO HAI JING ZHU (MMSI 414095000), and CHANG ZAN (MMSI 413307520), September 23-26, 2022, www.marinetraffic.com.

[9] "China Inland Waterways," *Worldwide Inland Navigation Network*, accessed November 22, 2022, https://www.wwinn.org/china-inland-waterways.

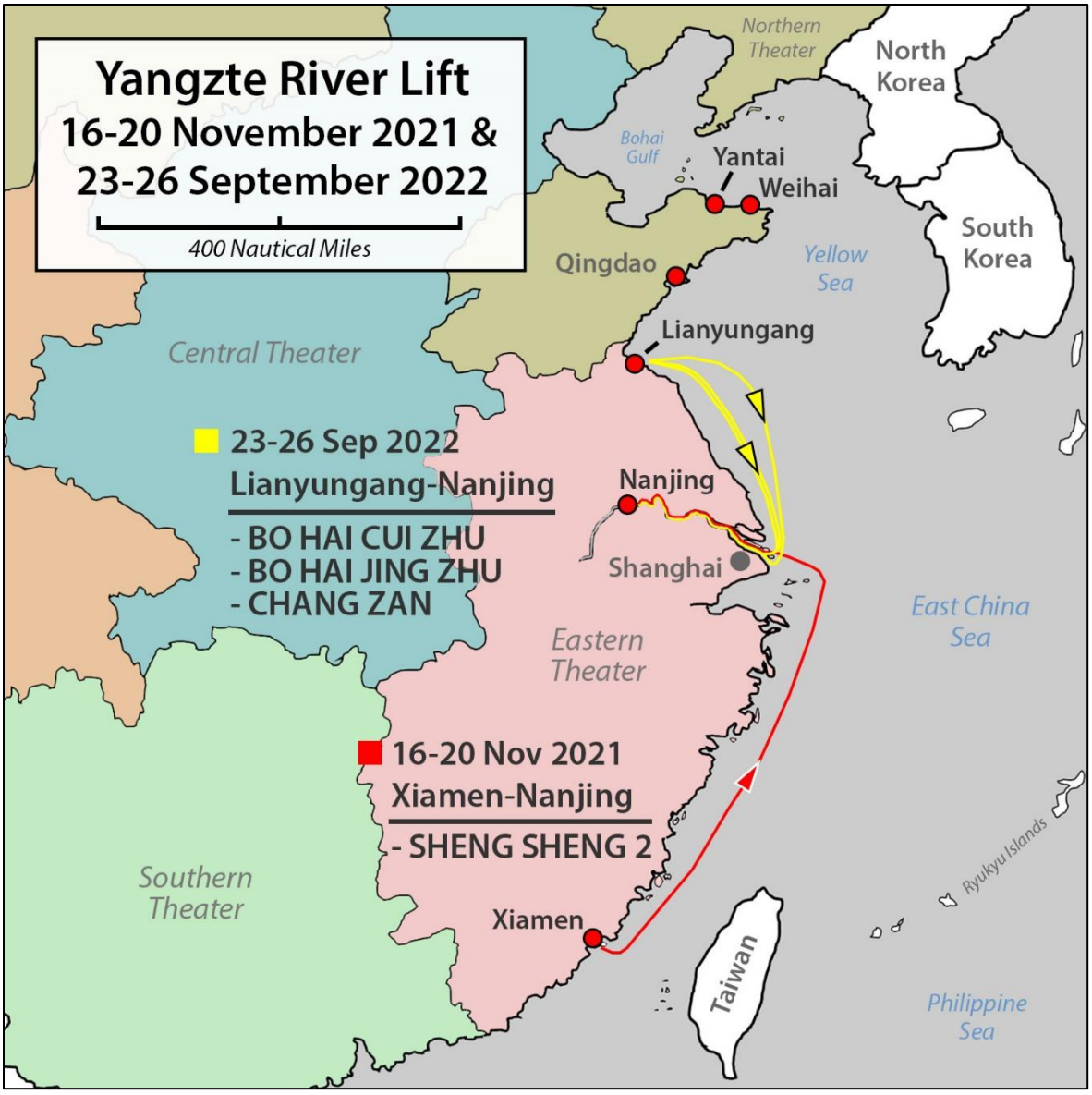

Figure 5. Yangzte River Lift, November 2021 and September 2022

Camouflage, Concealment, and Deception

Activity: In early August 2022, two RO-RO ferries transported a PLA 79th Group Army air defense brigade from Dalian, on the northern side of the Bohai Gulf, to Weifang on the southern side (see Table 5). This otherwise routine deployment of PLA troops and equipment by civilian ships revealed notable camouflage, concealment, and deception (CCD) to obscure the activity. A PLA video, released three weeks after the event, showed brigade vehicles entering a warehouse at Dalian Bay Port where they waited for an undetermined period, hidden from view, especially from satellite imagery. On 9 August, the military vehicles exited the warehouse and loaded onboard the JI LONG DAO RO-RO ferry. The loading evolution was further obscured by the use of tarps to effectively create tunnels that the vehicles drove under to reach the ship (see Figure 6).[10]

[10] 多军兵种跨昼夜海上兵力投送 ["Multi-Service Cross Sea Force Projection Spanning Day and Night"],央视军事 [CCTV Military], August 31, 2022, https://www.youtube.com/watch?v=8EZQM0ZRs5Q.

Table 5. Cross-Bohai Gulf Mobility Exercise, 9-11 August 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
CHANG SHAN DAO	长山岛	JI LONG DAO	吉龙岛
Ports			
Dalian Bay Port	大连湾港	Weifang Port	潍坊港

Figure 6. PLA Video of Loading at Dalian Bay Port Ferry Terminal, August 2022 (CCTV)[11]

[11] Ibid.

On 9 August 2022, the JI LONG DAO departed the Dalian terminal and proceeded along its normal ferry route, reaching the Yantai ferry terminal at midnight local time. JI LONG DAO then departed Yantai in the early morning hours of 10 August, arriving in Weifang eight hours later. This was probably another deception measure meant to obscure the ultimate destination of the air defense brigade. Another RO-RO ferry, the CHANG SHAN DAO, loaded elements of the brigade from a different Dalian ferry terminal, 7 nautical miles (13 kilometers) south of the terminal where JI LONG DAO loaded. CHANG SHAN DAO departed on 10 August and proceeded directly to Weifang, arriving on 11 August.[12]

Assessment: This event demonstrates how ferry terminals, port infrastructure, and civilian ships may be used by the PLA to obscure the movement of military forces, especially during a crisis. Staging equipment in large warehouses makes it virtually invisible to satellite imagery, including radar and infrared imagery. If RO-RO ships load military troops and equipment in ports they routinely frequent for commercial purposes and then disable their AIS transponders in transit, they could deploy PLA forces to an area of operations with little opportunity for advance warning of such a deployment.

Operations from Austere Ports

Activity: From 15-18 August 2022, smaller formations of military vehicles embarked on a RO-RO ferry at Dongshan (Fujian), were transported off the coast, and then returned to Dongshan to disembark the next day. The HAI YANG DAO, one of the smaller ocean-going ferries that ply the waters of the Bohai Gulf, docked at a relatively austere part of Dongshan Port (see Table 6). The area appears to be used for bulk cargo and has little cargo handling infrastructure. It also does not have a RO-RO ramp. HAI YANG DAO made three round trips over four days from Dongshan, stopping in the port for 4-6 hours each time.[13] No tugboats were observed supporting HAI YANG DAO's docking evolutions. Figure 7 shows HAI YANG DAO with its angled stern ramp extended and more than forty probable military vehicles staged for loading.

Table 6. Dongshan Tactical Loading Exercise, 15-18 August 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships		**Ports**	
HAI YANG DAO	海洋岛	Dongshan Port	东山港

Assessment: This event demonstrates how little port infrastructure or tugboat support may be required for civilian RO-RO ships involved in military operations. RO-RO ships may operate from virtually any port with an intact pier or quay wall, even if port infrastructure like cranes or RO-RO ramps are unavailable or damaged. In the absence of a RO-RO ramp, as was the case with this event, loading and unloading may need to be timed with high tides in areas with large tidal variations so the RO-RO ships are able to use their on-board ramps.[14]

[12] AIS position data: JI LONG DAO (MMSI 414510000) and CHANG SHAN DAO (MMSI 412331000), August 9-11, 2022, www.marinetraffic.com.

[13] AIS position data: HAI YANG DAO (MMSI 412468000), August 15-18, 2022, www.marinetraffic.com.

[14] If the RO-RO ship vehicle deck is lower than the pier, on board ramps may be challenged to angle up to the pier.

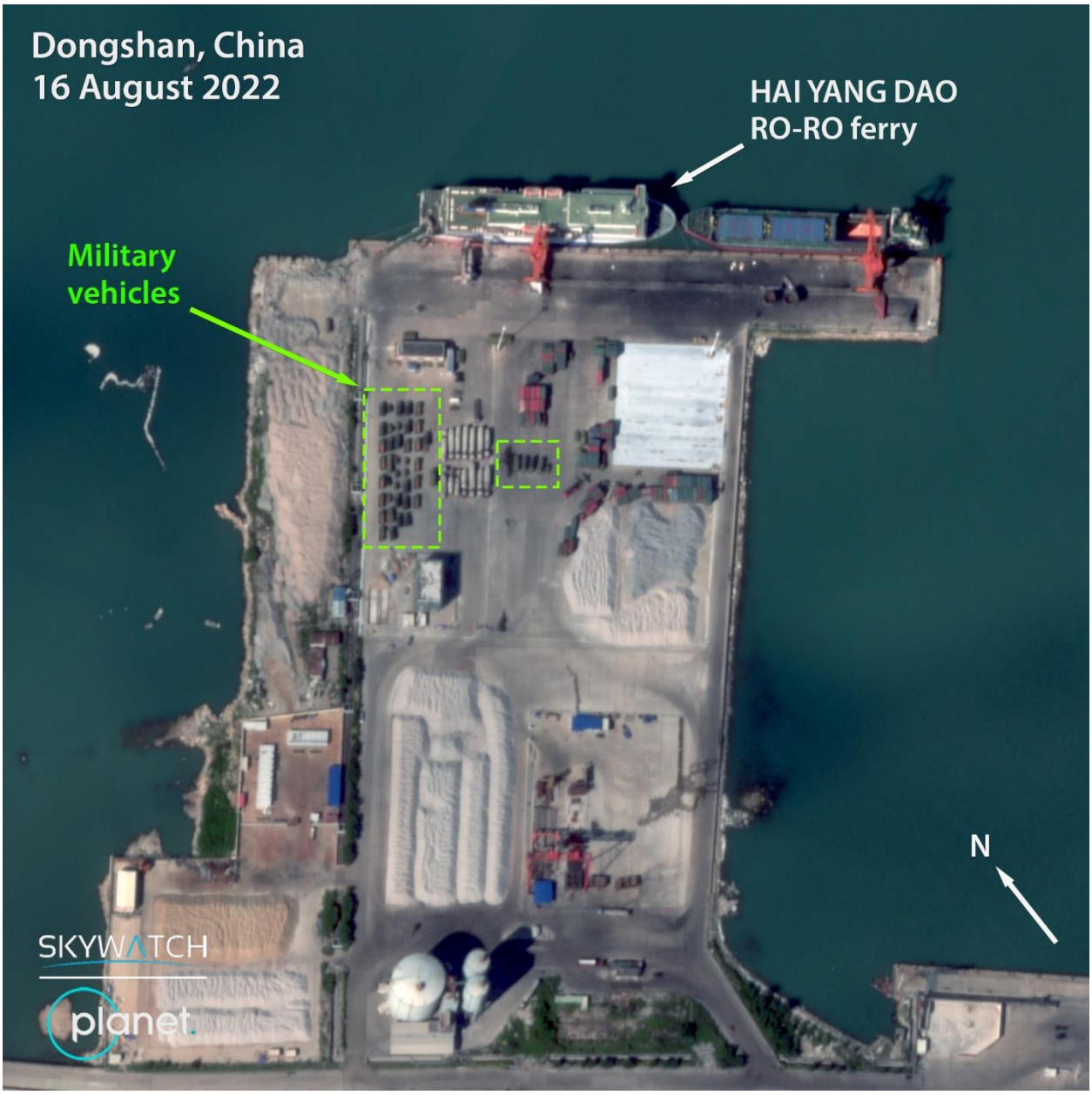

Figure 7. Dongshan, Fujian, 16 August 2022 (© 2022 Planet)[15]

[15] Planet, SkySat, Image ID: 20220816_073820_ssc16_u0001, August 16, 2022, Dongshan, China, 23.760N, 117.498E, SkyWatch EarthCache, www.skywatch.com.

Section 3. Large Volume Lift Exercises

Probably the most significant civil maritime-military event of 2022 was a complex, large volume lift exercise that took place up and down the Chinese coast from mid-July to mid-August 2022. Following this July-August large volume lift exercise (and immediately after the amphibious landing capstone exercise), another demonstration of lift capacity took place in September 2022 in and out of the northern ports of Tianjin and Jingtang, which is reviewed at the end of this section.

The July-August large volume lift exercise involved twelve civilian ships including eight large RO-RO ferries, one vehicle carrier, and three general cargo ships. Over the course of five weeks, these ships moved troops and military vehicles among ten ports and one PLAN base. During the exercise, ships may have unloaded and loaded at each port call, transiting fully loaded on each leg of their round-trip between ports. If ships were fully loaded for *each transit*, the total demonstrated lift capacity for this exercise was potentially over 8,500 military vehicles and 58,000 troops. Due to its complexity, the July-August exercise is examined in two different geographic areas of operation involving a northern group of ships and a southern group.

Northern Group Large Volume Lift

Activity: From 16 July-18 August 2022, a northern group of five ships operated between Rizhao (Shandong), Lianyungang (Jiangsu), and Qingdao (Shandong), moving military vehicles and troops in a coordinated large volume lift exercise (see Table 7). This northern group activity was supplemented by a long-haul lift of military equipment from Zhanjiang Naval Base in southern China to Qingdao and Weihai (Shandong) (see Table 8).

Table 7. Northern Group - Large Volume Lift Exercise, 16 July-18 August 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
BO HAI BAO ZHU	渤海宝珠	BO HAI YU ZHU	渤海玉珠
BO HAI MA ZHU	渤海玛珠		
General Cargo Ships			
SHENG TAI	盛泰	FU YUN 828	福运 828
Ports			
Lianyungang Port	连云港港	Rizhao Port	日照港
Qingdao Port	青岛港		

Table 8. Northern Group - South-North Long-Haul Lift, 22-26 July 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
JI LONG DAO	吉龙岛	LONG XING DAO	龙兴岛
Ports			
Qingdao Port	青岛港	Zhanjiang Naval Base	湛江海军基地
Weihai Port	威海港		

Northern group activity is examined in three apparent phases (see Figure 8):

Phase 1: 16-30 July

- Movement between Rizhao and Lianyungang
- Three ships: BO HAI BAO ZHU, BO HAI YU ZHU, and SHENG TAI

Phase 2: 22-26 July

- Movement from Zhanjiang Naval Base to Qingdao and Weihai
- Two ships: JI LONG DAO (to Qingdao) and LONG XING DAO (to Weihai)

Phase 3: 29 July-18 August

- Movement between Rizhao and Qingdao
- Three ships: BO HAI BAO ZHU, BO HAI MA ZHU, and FU YUN 828

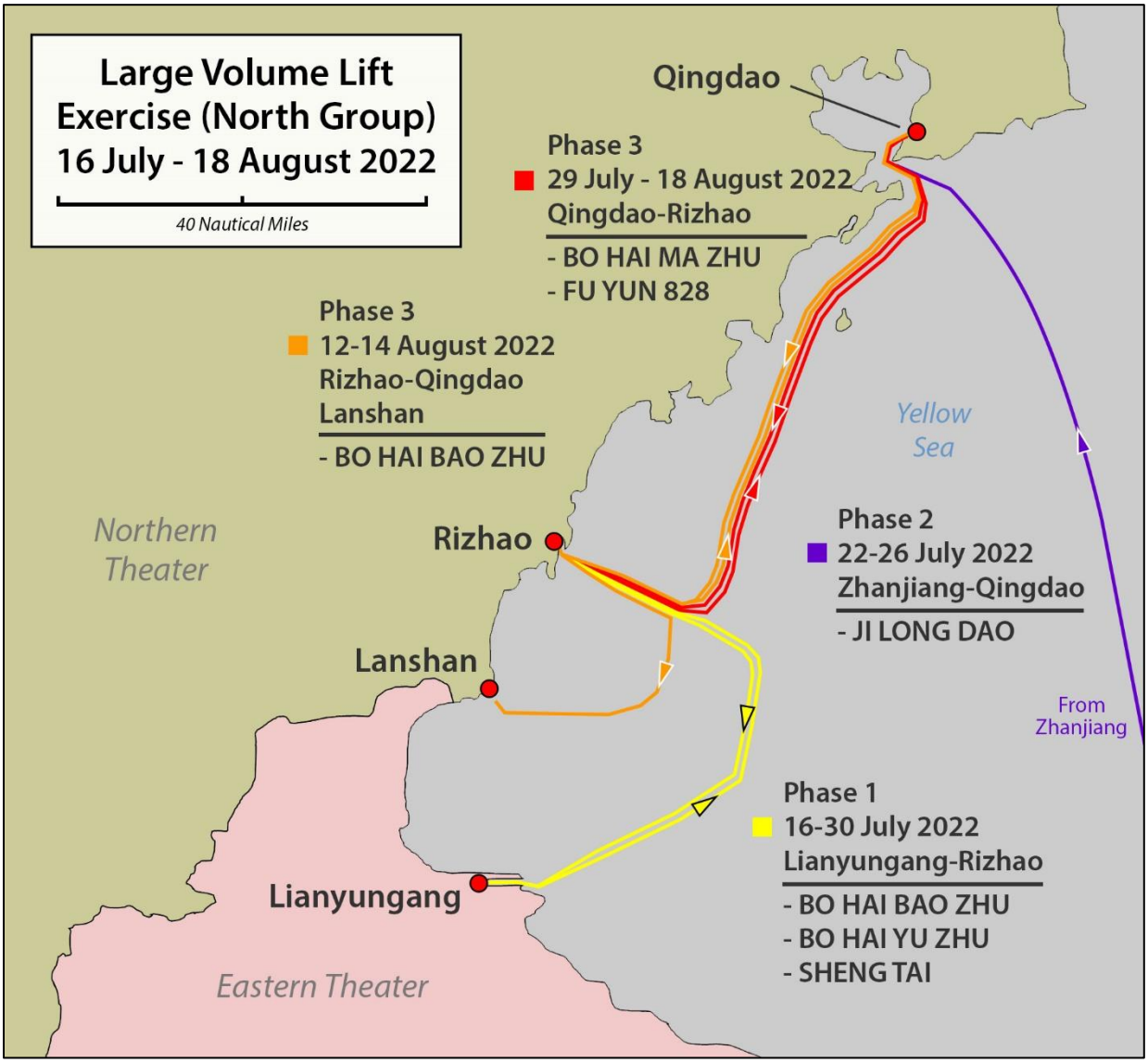

Figure 8. Large Volume Lift Exercise (North), 16 July-18 August 2022

In Phase 1, two large RO-RO ferries and one general cargo ship moved military vehicles and troops between Lianyungang and Rizhao. Based on AIS data, the three ships made six round trips between the two ports for twelve lifts total.[16] Whether ships were laden with equipment and personnel on each transit could not be definitively established based on available data.

A commercial satellite image of Rizhao (see Figure 9) shows military loading activity in Rizhao on 22 July 2022. At the time this image was captured, the BO HAI YU ZHU was about to depart and had probably just finished loading. The general cargo ship SHENG TAI had just departed the location where BO HAI BAO ZHU was maneuvering for a stern docking, also called a "Mediterranean mooring." There were approximately 138 vehicles, including armored vehicles, trucks, and tactical vehicles, apparently staged for loading onto the RO-RO ferry.[17] The image may appear to support the "one-way lift only" assessment since the staged vehicles would likely obstruct any offload if, in fact, BO HAI BAO ZHU had vehicles onboard to disembark. However, BO HAI BAO ZHU had been in Rizhao a day earlier when it had probably off-loaded vehicles. The ship went to and from the Rizhao anchorage the night of 21 July, most likely empty, and did not visit Lianyungang again before returning to Rizhao.

Phase 2 of the exercise involved two RO-RO ferries conducting a long-haul lift of troops and equipment from Zhanjiang Naval Base, moving their cargo 1400 nautical miles (2600 kilometers) north to Qingdao and Weihai. Figure 10 shows the LONG XING DAO in the process of loading military vehicles staged on the roads near the pier. The JI LONG DAO, a relatively new RO-RO ferry that entered service in 2021, departed Zhanjiang before LONG XING DAO arrived and proceeded to Qingdao, arriving on 25 July 2022. LONG XING DAO proceeded farther north to discharge its military cargo at the ferry terminal in Weihai.[18]

Phase 3 began on 29 July with the RO-RO ferry BO HAI MA ZHU and the general cargo ship FU YUN 828 transporting troops and military vehicles between Rizhao and Qingdao. In contrast to the relatively fast pace exhibited in Phase 1, BO HAI MA ZHU and FU YUN 828 spent between one- and three-days quayside during most Phase 3 port calls.[19] Whether there was active loading and unloading during those long in-port periods could not be determined in all cases.

In the third week of Phase 3, BO HAI BAO ZHU returned to the exercise, first calling in Rizhao then proceeding to Qingdao for half a day before returning to Rizhao. BO HAI BAO ZHU next paid a single visit to Lanshan (Shandong), for unknown reasons. The ship may have simply been redeploying exercise elements or logistics troops to Lanshan before returning to its Bohai Gulf ferry route.

[16] AIS position data: BO HAI BAO ZHU (MMSI 412330020), BO HAI YU ZHU (MMSI 413408000), and SHENG TAI (MMSI 412081630), July 16-30, 2022, www.marinetraffic.com.

[17] Figure is approximate because a handful of vehicles were not visible, obscured by the gantry crane.

[18] AIS position data: JI LONG DAO (MMSI 414510000) and LONG XING DAO (MMSI 412900000), July 17-26, 2022, www.marinetraffic.com.

[19] AIS position data: BO HAI BAO ZHU (MMSI 412330020), August 11-15, 2022, www.marinetraffic.com.

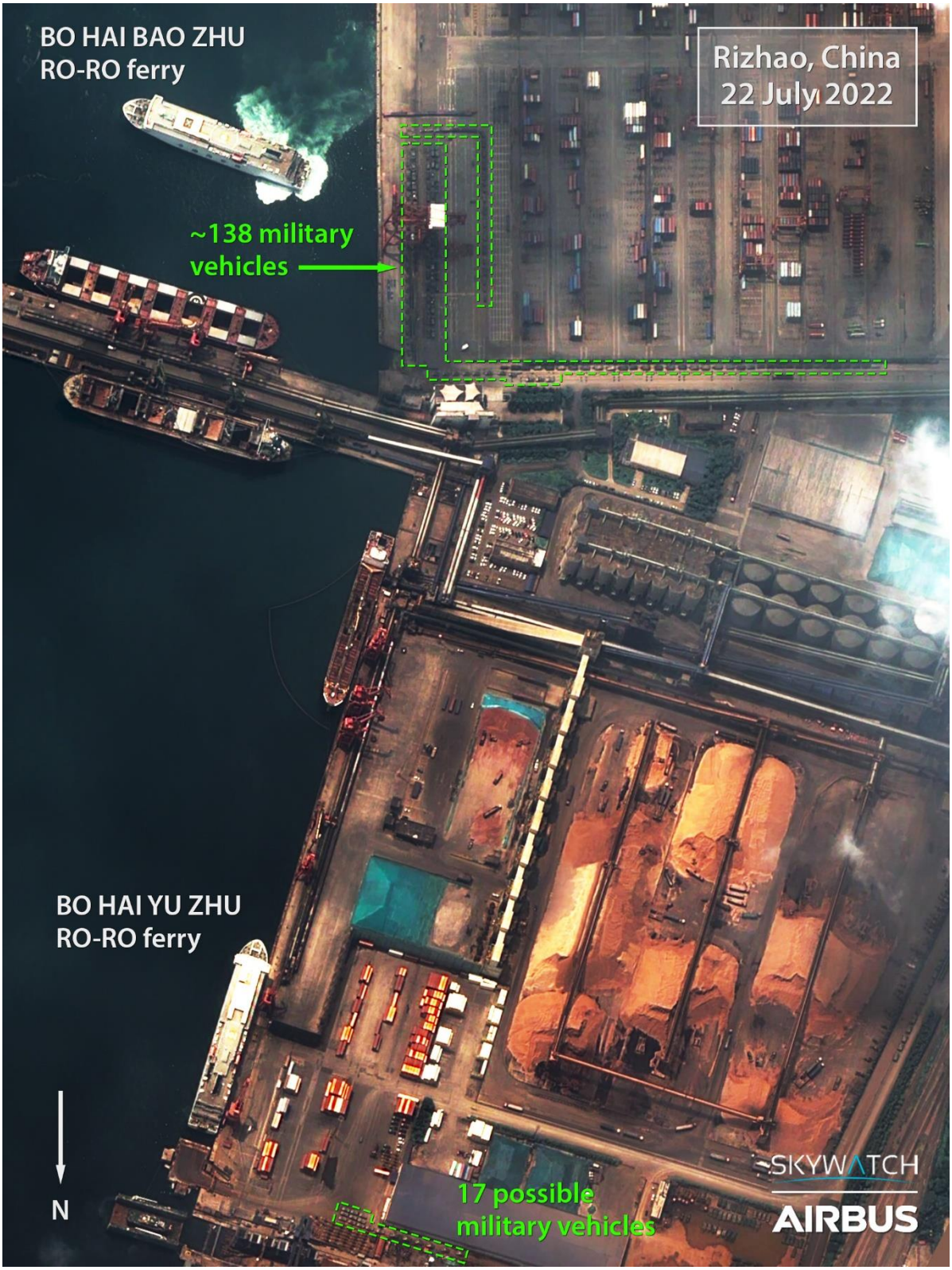

Figure 9. Rizhao, Shandong, 22 July 2022 (© 2022 Airbus)[20]

[20] Airbus, Pleiades, Image ID: DS_PHR1A_202207220252361_YZ2_PX_E119N35_0710_01617, July 22, 2022, Rizhao, China, 35.376N, 119.535E, SkyWatch EarthCache, www.skywatch.com.

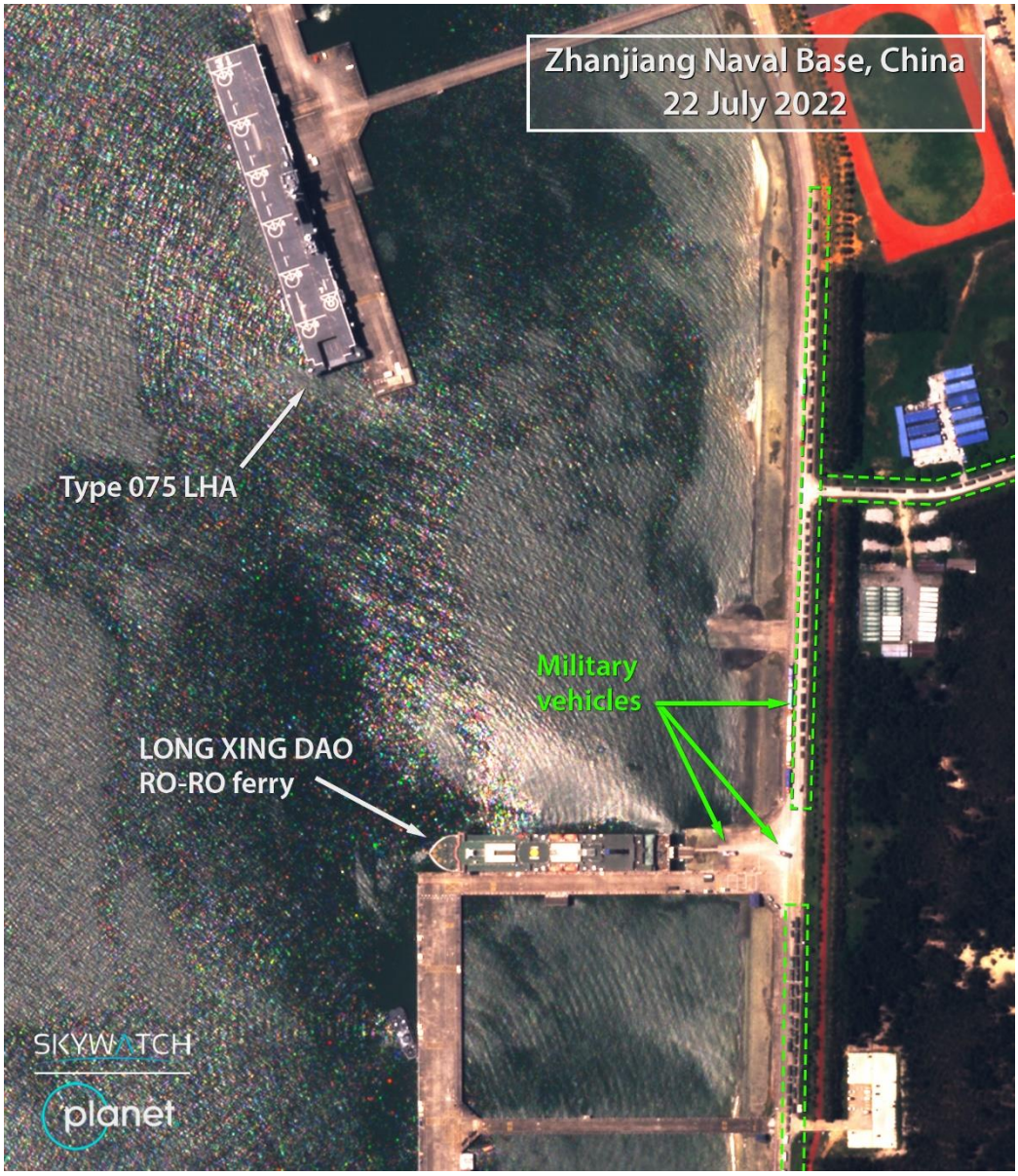

Figure 10. Zhanjiang Naval Base, Guangdong, 22 July 2022 (© 2022 Planet)[21]

Two high-resolution satellite images of Qingdao captured on 5 August 2022 provide some indications that ships were laden with military vehicles on both legs of their round trips. Figure 11, a satellite image taken at approximately 0900 local time, shows a convoy of 110 vehicles that had probably just unloaded from the BO HAI MA ZHU. Two tank companies, a total of 24 tanks that appear in an inset, probably also had just unloaded from the BO HAI MA ZHU for a total of 134 vehicles embarked on the RO-RO ferry.[22] Eighteen other armored vehicles also appear in an inset next to the FU YUN 828. The 152 vehicles unloaded from the two ships probably represent a single PLAA heavy combined arms battalion.

[21] Planet, SkySat, Image ID: 20220722_061750_ssc8_u0001, July 22, 2022, Zhanjiang Naval Base, China, 21.230N, 110.441E, SkyWatch EarthCache, www.skywatch.com.

[22] Tanks would not join the convoy since their weight and tracks might damage roads and would instead be moved by rail or heavy equipment transport.

Figure 11. Vehicle Unloading, Qingdao, China, 5 August 2022 (Google Earth/Maxar)[23]

[23] Google Earth Pro 7.3.6.9285, August 5, 2022, Qingdao, China, 36.104N 120.326E, Maxar Technologies 2022.

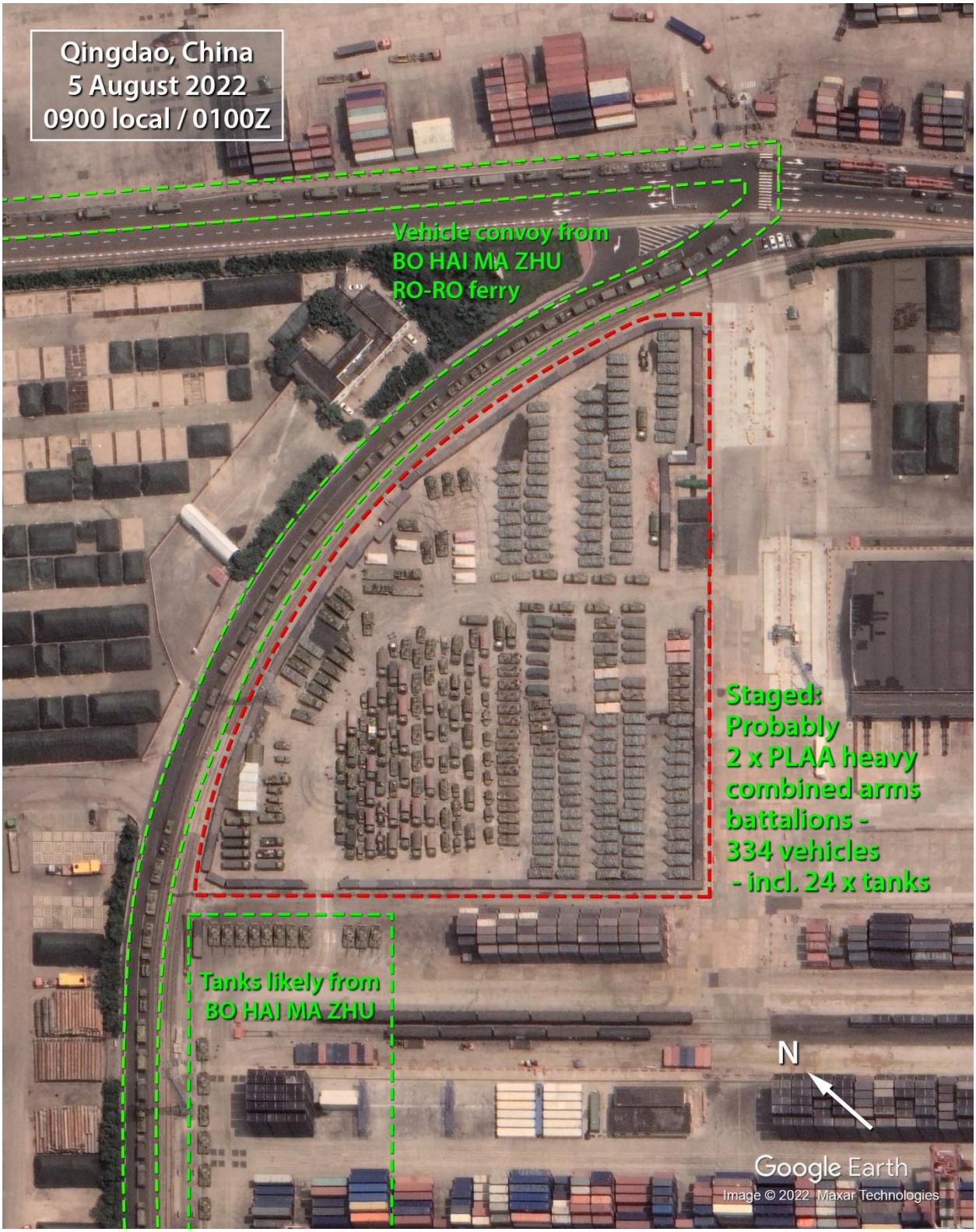

Figure 12. Heavy Combined Arms Battalions, Qingdao, Shandong, 5 August 2022 (Google Earth/Maxar)[24]

[24] Google Earth Pro 7.3.6.9285, August 5, 2022, Qingdao, China, 36.104N 120.326E, Maxar Technologies 2022.

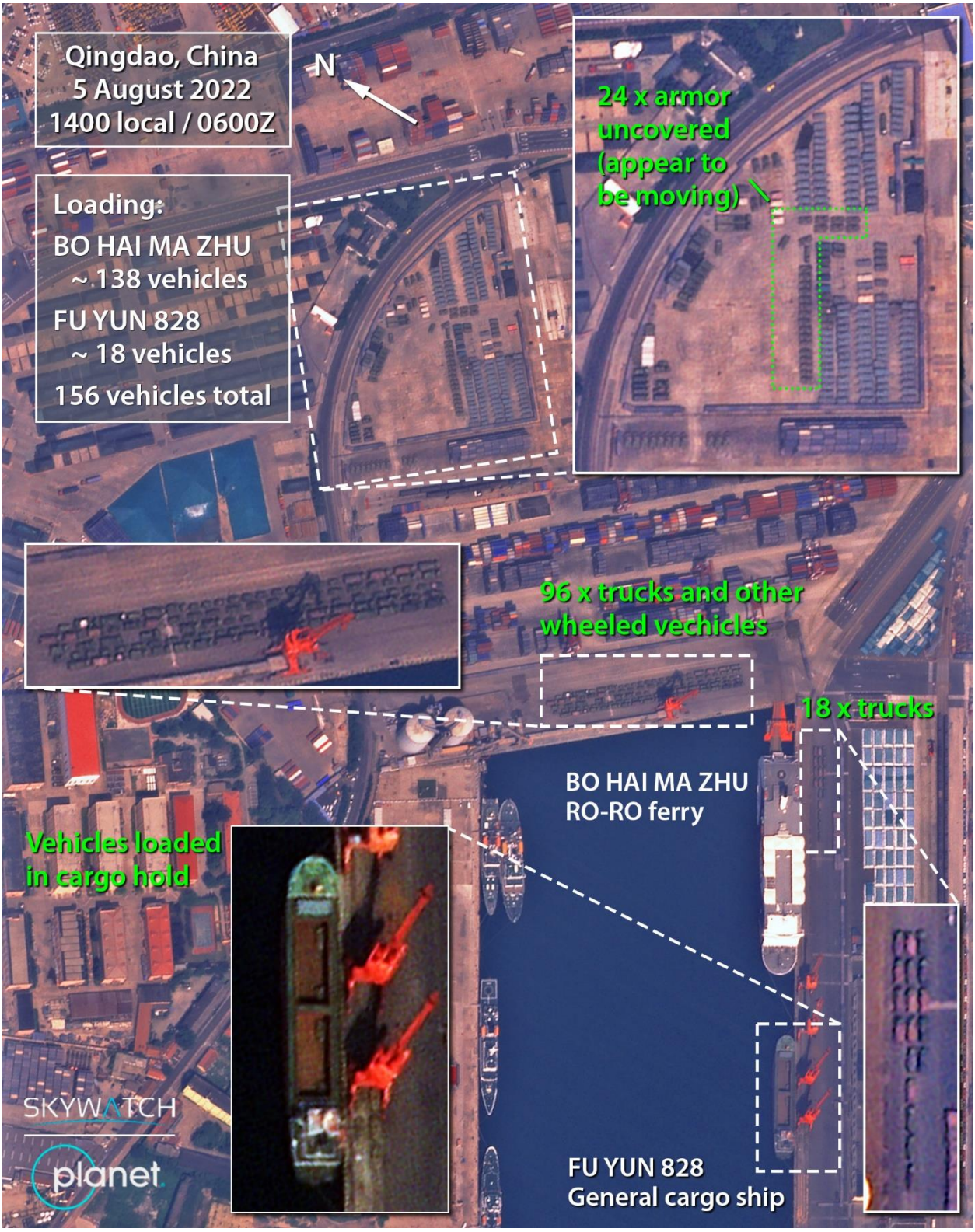

Figure 13. Vehicle Loading Preparations, Qingdao, Shandong, 5 August 2022 (© 2022 Planet)[25]

[25] Planet, SkySat, Image ID: 20220805_055910_ssc8_u0001, August 5, 2022, Qingdao, China, 36.104N 120.326E, SkyWatch EarthCache, www.skywatch.com.

Adjacent to the convoy route, 334 military vehicles are packed into a staging area at the port (see Figure 12). Many vehicles are covered, but twenty-four tanks can be distinguished from other armor. These 334 vehicles probably constitute two PLAA heavy combined arms battalions.[26] A satellite image taken six hours after the first 5 August image, shows 114 military vehicles moved from the staging area to the quay near the BO HAI MA ZHU (see Figure 13). Twenty-four armored vehicles in the staging area were uncovered and appeared to be moving, possibly toward the loading area. Those 138 vehicles are four more than what were unloaded from the RO-RO ferry that morning. Other vehicles being loaded into FU YUN 828 are obscured by cranes, but four vehicles can be seen loaded into the ship's cargo hold.

Assessment: This northern group evolution was a significant demonstration of the PLA's ability to move a large volume of military equipment and personnel through ports using civilian shipping. Calculations of potential lift capacity appear in Table 11 at the end of this section. Assuming one-way lifts only, the northern group activity alone would probably total some 3,000 vehicles and 21,000 troops. If all ships were fully loaded on each transit, totals would add up to more than 5,800 vehicles and over 40,000 troops. The actual total probably lies somewhere in between.

The satellite imagery of northern group loading activity provides insights into how many military vehicles would likely be loaded onto civilian ships as a matter of practice. Most large, ocean-going ferries are advertised as carrying between 300 and 350 civilian vehicles, a count that probably includes relatively small automobiles. Calculations of a ship's vehicle deck area divided by the area occupied by a mix of tanks, trucks, and tactical vehicles would certainly yield an estimate of the maximum load for a RO-RO ferry or other ship.

On a practical level, however, PLA units will likely be transported only as complete units. If large parts of PLA units were split and one ship in a group were sunk or otherwise prevented from reaching its destination, units might arrive missing important elements. For example, tanks might arrive, but ammunition, maintenance personnel, and spare parts may not, significantly impacting the unit's ability to operate at the destination. Using ships like SHENG TAI or FU YUN 828 to transport a handful of armored vehicles during this exercise may have provided necessary excess capacity or may have been done simply to exercise procedures with general cargo ships.

Based on these observations and other open-source research, a PLAA heavy CA battalion likely consists of 150-160 vehicles—tanks, armor, trucks, and other vehicles. Given four battalions in each heavy CA brigade, these numbers are consistent with observations of the September 2022 loading exercise at Tianjin, reviewed later in this section. While a large RO-RO ferry or vehicle carrier might be capable of carrying more vehicles or troops, a single armored unit consisting of ~150 vehicles and ~1000 personnel is a reasonable estimate of what civilian ships will probably carry in practice. RO-RO ferries or vehicle carriers may embark more than one battalion of smaller formations with lighter vehicles like those in PLA medium or light combined arms battalions.

Southern Group Large Volume Lift

Activity: From 14 July-4 August 2022, a southern group of three ships participated in the large volume lift exercise and operated between Ningde (Fujian), Jiangyin (Fujian), Guang'ao (Guangdong), and Xiamen (Fujian), probably moving military vehicles and troops (see Table 9). Like the northern group activity, this southern group activity was supplemented by a long-haul lift of military equipment, in this case from Tianjin to Guang'ao (see Table 10).

[26] ~154 vehicles per battalion (308 total) plus ~30 vehicles that may belong to brigade support or headquarters units.

Table 9. Southern Group - Large Volume Lift Exercise, 14-25 July 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
BO HAI ZHEN ZHU	渤海珍珠	DA FENG GANG LI MING HAO	大丰港黎明号
General Cargo Ships			
CHANG ZAN	长赞		
Ports			
Guang'ao Port	广澳港	Xiamen Cruise Terminal	厦门邮轮码头
Jiangyin Port	江阴港	Xiamen Xiangyu Wharf	厦门象屿码头
Ningde Port	宁德港		

Table 10. Southern Group - North-South Long-Haul Lift, 27 July-4 August 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
BO HAI ZHEN ZHU	渤海珍珠	ZHONG HUA FU XING	中华复兴
BO HAI ZUAN ZHU	渤海钻珠		
Ports			
Tianjin Int'l Cruise Ship Terminal	天津国际邮轮母港	Guang'ao Port	广澳港

Southern group activity is examined in two apparent phases, each involving three ships (see Figure 14):

Phase 1a: 14-25 July

- Movement between Ningde, Jiangyin, and Xiamen
- Two ships: DA FENG GANG LI MING HAO and CHANG ZAN

Phase 1b: 17-24 July

- Movement from Guang'ao, Jiangyin, and Xiamen
- One ship: BO HAI ZHEN ZHU

Phase 2: 27 July-4 August

- Movement between Tianjin and Guang'ao
- Three ships: BO HAI ZHEN ZHU, BO HAI ZUAN ZHU, and ZHONG HUA FU XING

Phase 1 of the southern group exercise apparently took place in two parts. In Phase 1a, the RO-RO vehicle carrier DA FENG GANG LI MING HAO and the general cargo ship CHANG ZAN transited between Ningde and the container terminal at Jiangyin before shifting to transits between Jiangyin and Xiamen. Similarly, in Phase 1b, the RO-RO ferry BO HAI ZHEN ZHU transited between Guang'ao, Xiamen, and Jiangyin before also shifting to transits between Jiangyin and Xiamen.[27] While no commercial satellite imagery was available to provide confirmation, the observed pattern

[27] AIS position data: DA FENG GANG LI MING HAO (MMSI 413239310), CHANG ZAN (MMSI 413307520), and BO HAI ZHEN ZHU (MMSI 413409000), July 14-25, 2022. www.marinetraffic.com.

suggests that troops and equipment were probably first consolidated at Jiangyin before the transits shifted to lifting troops and equipment to Xiamen. Like the northern group, it is possible that each ship in the southern group was loaded with vehicles and personnel on each transit to demonstrate maximum lift capacity during the exercise. The RO-RO ships made seven or eight transits each while the CHANG ZAN made four transits between ports.

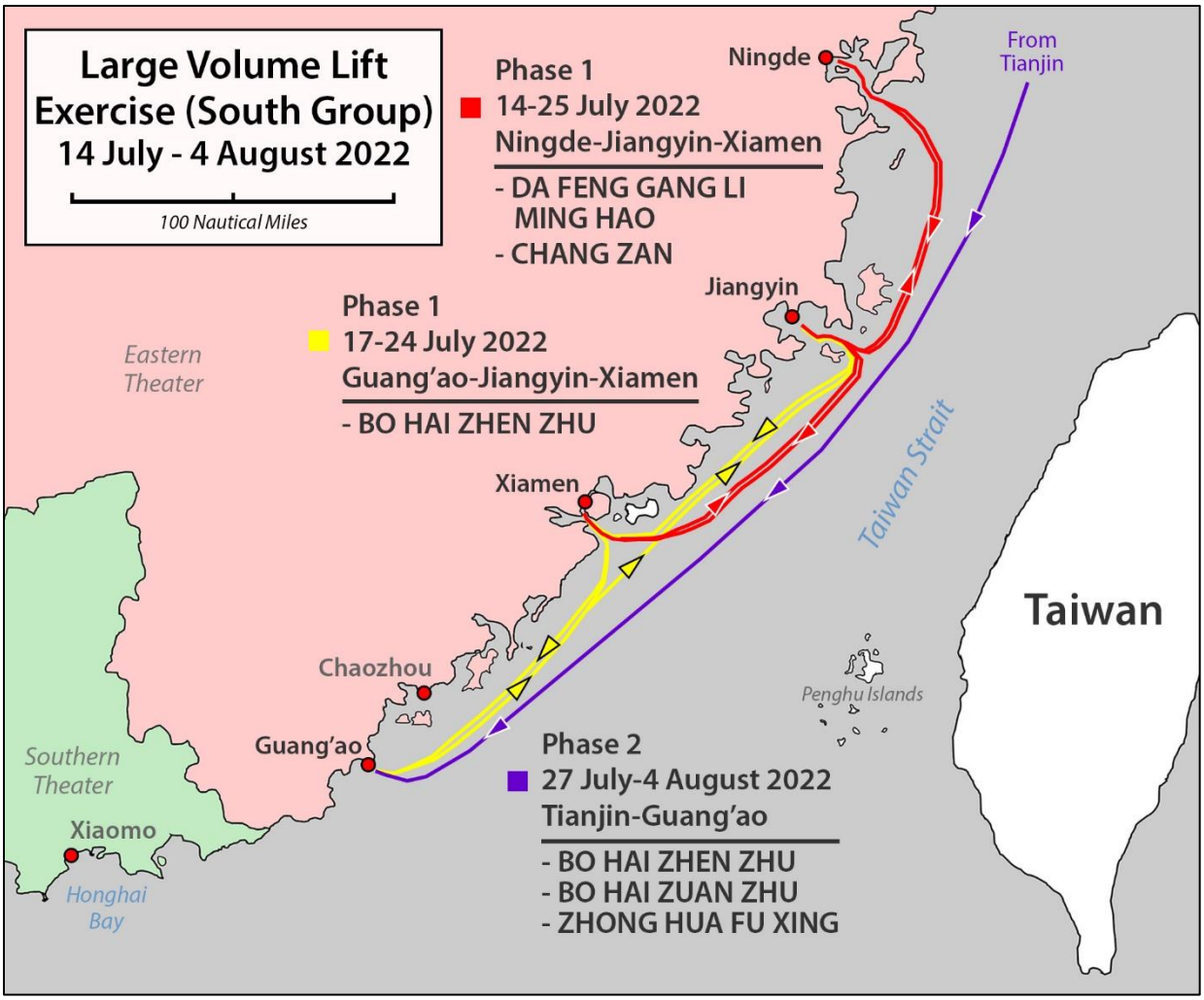

Figure 14. Large Volume Lift Exercise (South), 14 July-4 August 2022

Phase 2 of the southern group activity began on 27 July 2022, when the BO HAI ZUAN ZHU and ZHONG HUA FU XING departed their Bohai Gulf ferry routes and loaded military vehicles and troops at the Tianjin International Cruise Ship Terminal, the same terminal used in the September 2022 loading exercise outlined in the next section of this report. BO HAI ZHEN ZHU transited 1,200 nautical miles (2222 kilometers) from the southern exercise area to Tianjin to collect troops and equipment from the terminal (see Figure 15). All three ships then proceeded to Guang'ao, presumably to off-load their military cargo.[28]

[28] AIS position data: BO HAI ZUAN ZHU (MMSI 414210000), ZHONG HUA FU XING (MMSI 413384000), and BO HAI ZHEN ZHU (MMSI 413409000), July 24-August 4, 2022. www.marinetraffic.com.

Figure 15. Tianjin International Cruise Ship Terminal, China, 29 July 2022 (© 2022 Airbus)[29]

[29] Airbus, Pleiades-Neo, Image ID: PNEO4_202207290250446_PMS-FS_ORT, July 29, 2022, Tianjin, China, 38.975N, 117.820E, SkyWatch EarthCache, www.skywatch.com.

Assessment: The southern group activity in this large volume lift exercise was about half the size of the northern group activity. Assuming one-way lifts only, the southern group activity would probably total more than 1,600 vehicles and 11,000 troops. If all ships were loaded on each transit, totals would add up to more than 2,700 vehicles and 18,000 troops.

It is possible that there was a Phase 3 to the southern group portion of the exercise. Two RO-RO ships, the cargo ship CHANG ZAN and the cargo ship SHENG TAI, which had been involved in northern group exercise activity, moved between several Southern and Eastern Theater ports between 11-18 August 2022. This activity coincided with northern group Phase 3 activity. However, this port-to-port activity did not feature the repeated roundtrips demonstrated in the rest of the large volume lift exercise. Some of these observed one-way lifts may have been the redeployment of exercise forces to their home bases at the end of the southern group portion of the large volume lift exercise.[30]

Overall Assessment of Large Volume Lift Exercise

This large volume lift exercise was a significant demonstration of the PLA's ability to use civilian shipping and ports to move a large volume of military equipment and personnel. As it relates to the potential for civilian shipping lift to support a cross-strait invasion of Taiwan, one of the principal deficiencies noted in previous assessments civil maritime-military activity was the lack of this demonstrated lift capacity.[31] This evolution observed in 2022 shows a capability and requisite capacities using civilian shipping not previously observed in PLA exercises.

Calculations of potential lift capacity demonstrated in this large volume lift exercise appear in Table 11. These figures are only rough estimates that collectively provide a sense of scale and represent the potential for civilian ships to lift large volumes of military personnel and equipment. On a practical level, it is entirely possible, if not likely, the PLA loaded and unloaded a single representative unit multiple times to exercise logistics personnel and simulate the volume of troops and materiel that could be put through a port.

Civilian ships conducted 82 individual transits during this exercise. Satellite imagery of northern group activity suggested much of the exercise was focused on moving second echelon forces such as heavy combined arms brigades, possibly as they would in a cross-strait contingency. Calculations in Table 11 are based on the nominal size of a PLAA heavy combined arms battalion—154 vehicles and approximately 1000-1100 personnel. Assuming such a load and assuming the RO-RO ships and cargo ships moved personnel and equipment in each of the 82 transits, over 8,500 military vehicles and 58,000 personnel may have been moved during this five-week exercise.

The majority of lift capacity in this exercise was from eight of the 31 available ocean-going RO-RO ferries (26 percent). The pacing of the exercise, with long in-port periods in many cases, appeared slow and methodical. However, it is easy to imagine a scaled-up version of this approach being used to move significant volumes of vehicles, material, and troops across the Taiwan Strait in just a few days or weeks.

[30] Potential southern group Phase 3 AIS position data and ports include: CHANG ZAN (MMSI 413307520), to Dongshan; DA FENG GANG LI MING HAO (MMSI 413239310) and QI ZI WAN (MMSI 413895000), Guang'ao to Nansha; and SHENG TAI (MMSI 412081630), Gulei to Chaozhou, August 11-18, 2022, www.marinetraffic.com.

[31] Dahm, "Chinese Ferry Tales," p. 54.

Table 11. Large Volume Lift Exercise Totals, July-August 2022[32]

Ship Name	One-Way Lifts	Total Vehicles	Total Troops	Lifts if Loaded Each Way	Total Vehicles	Total Troops
Northern Lift: Lianyungang-Rizhao						
BO HAI YU ZHU	6	912	6000	12	1,848	12,000
BO HAI BAO ZHU	6	816	6000	12	1,632	12,000
SHENG TAI	6	108	600	12	216	1,200
Northern Lift: Qingdao-Rizhao						
BO HAI BAO ZHU	1	154	1,000	2	308	2,000
BO HAI MA ZHU	5	680	5,000	10	1,360	10,000
FU YUN 828	5	90	500	10	180	1,000
South-North Long-Range Lift (One-Way Only): Zhanjiang-Qingdao/Weihai						
JI LONG DAO	1	154	1,000	1	154	1,000
LONG XING DAO	1	154	1,000	1	154	1,000
Northern Group Totals:	**31**	**3,068**	**21,100**	**60**	**5,852**	**40,200**
Southern Lift: Guang'ao-Xiamen-Jiangyin						
BO HAI ZHEN ZHU	4	616	4,000	7	1,078	7,000
Southern Lift: Ningde-Jiangyin-Xiamen						
DA FENG GANG LI MING HAO	4	544	4,000	8	1,088	8,000
CHANG ZAN	2	36	200	4	72	400
North-South Long-Range Lift (One-Way Only): Tianjin-Guang'ao						
BO HAI ZHEN ZHU	1	154	1,000	1	154	1,000
BO HAI ZUAN ZHU	1	154	1,000	1	154	1,000
ZHONG HUA FU XING	1	154	1,000	1	154	1,000
South Group Totals:	**13**	**1,658**	**11,200**	**22**	**2,700**	**18,400**
July-August 2022 Lift Totals:	**44**	**4,726**	**32,300**	**82**	**8,552**	**58,600**

Despite the impressive volume demonstrated in this exercise, it is important to note the very controlled conditions under which these events were conducted. The PLA had complete control over designated sections of civilian ports. Supporting infrastructure was intact. The PLA also had the authority to stop and direct civilian traffic to move forces in and out of ports rapidly and efficiently. Challenges created by damaged ports or transportation infrastructure on either side of the Taiwan Strait could significantly limit logistics throughput. Protecting embarkation ports, seizing Taiwan ports intact, and keeping them secure as civilian ships transit in and out will be critical tasks for the PLA in real-world port-to-port operations. Still, there is a certain "quality in quantity." This 2022 exercise stands as a benchmark demonstrating the PLA's use of civilian shipping to move large volumes of troops and equipment. This capability will almost certainly improve over time, exercised as a critical component of a potential Taiwan invasion scenario.

[32] "One-Way Lifts" assumes vehicles and troops are moved only in one-direction, with the ship returning empty. "Loaded Each Way" assumes a full load of vehicles and troops for each lift going in both directions. Count assumes each lift involves a heavy combined arms battalion of ~1000 troops and ~154 vehicles either loaded on one RO-RO ferry or split between a ferry (~136 vehicles) and a cargo ship (~18 vehicles).

Heavy Combined Arms Brigade Loading Exercise

Activity: In addition to the large volume lift exercise reviewed above and the amphibious landing capstone exercise examined in the next section, a third major exercise took place in Tianjin and Jingtang (Hebei) on the Bohai Gulf in mid-September 2022. The exercise involved half-a-dozen RO-RO ferries, three cargo ships, and a PLAA heavy combined arms brigade staged in the port of Tianjin (see Table 12). Throughout the five-day exercise, ferries and cargo ships docked and apparently loaded and unloaded PLAA vehicles. After several hours in port, ships proceeded to anchorages offshore, probably with military vehicles embarked. The next day, the ships returned to port presumably to off-load. There are no indications PLAA forces departed Tianjin or Jingtang by ship as part of the exercise. The reason for this ostensibly inefficient use of a large PLAA formation and civilian transportation resources was probably to exercise loading and unloading procedures and possibly simulate the transshipment of large PLAA formations.

Table 12. Tianjin/Jingtang Heavy Combined Arms Loading Exercise, 12-17 September 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
BO HAI JING ZHU	渤海金珠	ZHONG HUA FU XING	中华复兴
BO HAI ZHEN ZHU	渤海珍珠	CHANG SHAN DAO	长山岛
BO HAI ZUAN ZHU	渤海钻珠	LONG XING DAO	龙兴岛
General Cargo Ships			
CHANG ZAN	长赞	SHENG TAI	盛泰
XINHAISHENG 8	新海升 8		
Ports			
Tianjin Int'l Cruise Ship Terminal	天津国际邮轮母港	Jingtang Port	京唐港
Tianjin Port	天津港		

By mid-August 2022, elements of a PLAA heavy combined arms brigade began to arrive at the Tianjin International Cruise Ship Terminal, according to commercial satellite imagery.[33] By late August, the entire brigade had deployed to the terminal. Satellite imagery from 27 August showed over 600 military vehicles in the terminal's parking lot.[34] Since the onset of the COVID-19 pandemic, the cruise ship terminal has been largely idle, occasionally used to load fleets of cars and other commercial vehicles onto large vehicle carrier ships.

The brigade's appearance in August was accompanied by the arrival of the XINHAISHENG 8, a deck cargo ship equipped with what appears to be a loading ramp.[35] The ramp probably allows vehicles to embark and disembark as the ship's deck raises and lowers with the tide relative to a pier or quay wall. A vehicle can be seen using the loading ramp in the inset of Figure 16.

[33] Planet, PlanetScope-SuperDove, Image ID: 20220817_022948_75_248e, August 17, 2022, and Image ID: 20220820_015757_52_2463, August 20, 2022, Tianjin, China, 38.975N, 117.820E, SkyWatch EarthCache, www.skywatch.com.

[34] Airbus, Pleiades, Image ID: DS_PHR1A_202208270314158_FR1_PX_E117N38_1124_01240, August 27, 2022, Tianjin, China, 38.975N, 117.820E, SkyWatch EarthCache, www.skywatch.com.

[35] AIS position data: XINHAISHENG 8 (MMSI 413288610), Aug 16-Sep 20, 2022, www.marinetraffic.com.

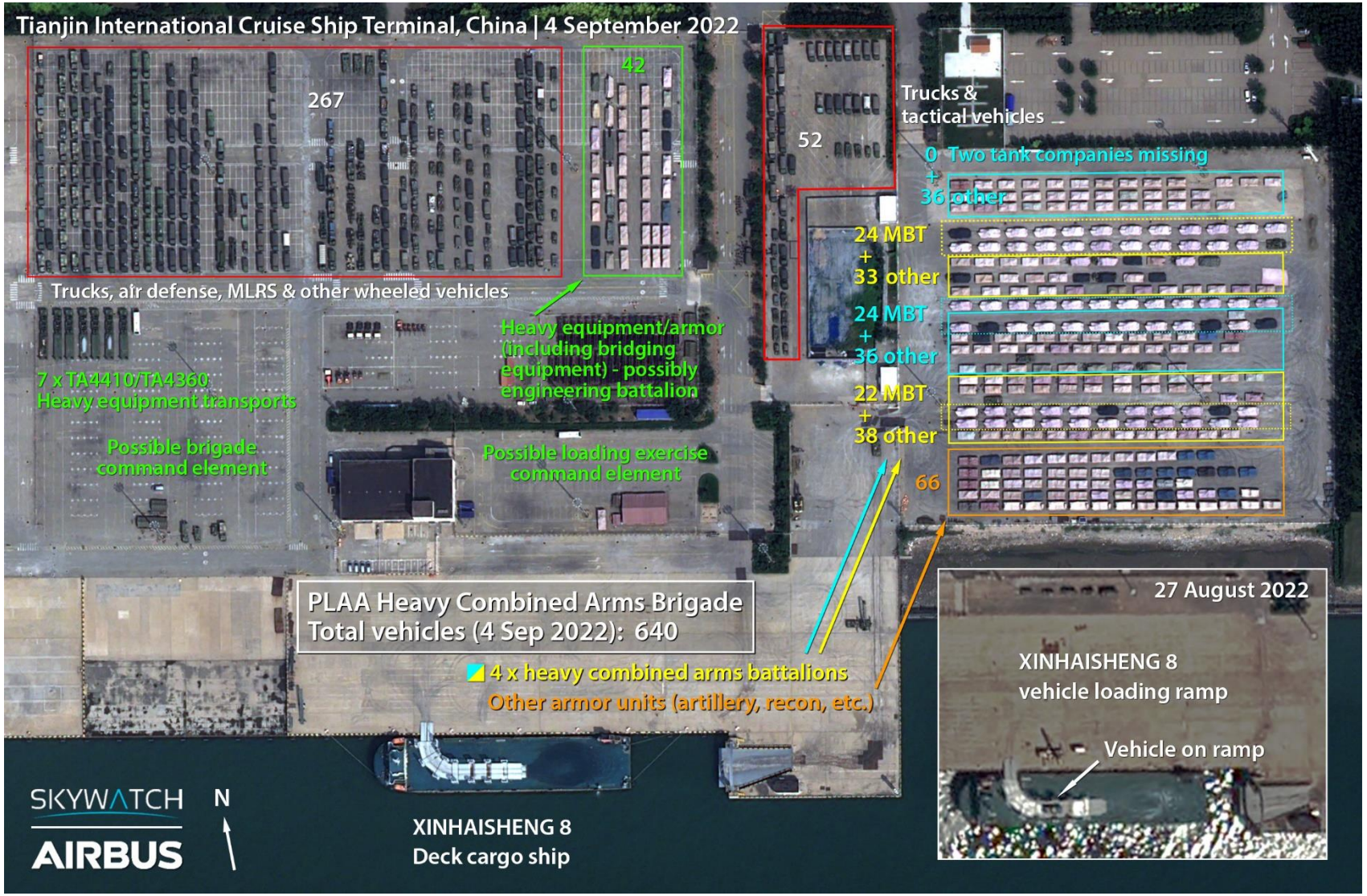

Figure 16. Tianjin International Cruise Ship Terminal, China, 4 September 2022 (© 2022 Airbus)[36]

[36] Airbus, Pleiades-Neo, Image ID: PNEO4_202209040301597_PMS-FS_ORT, September 4, 2022, Tianjin, China, 38.975N, 117.820E (Inset: Pleiades, Image ID: DS_PHR1A_202208270314158_FR1_PX_E117N38_1124_01240, August 27, 2022), SkyWatch EarthCache, www.skywatch.com.

Figure 16 is a high-resolution commercial satellite image (~30 cm resolution) that reveals details identifying this formation as a heavy combined arms brigade. The vehicles parked at the port include air defense vehicles, multiple launch rocket systems (MLRS), and elements of a possible engineering battalion with combat bridging equipment. Even through most of the armor on the right side of the image is covered, main battle tanks (MBTs) can be distinguished from smaller armor. Six companies of MBTs (11-12 per company, 70 total) appear to be parked with other companies of vehicles that probably include infantry fighting vehicles and self-propelled mortars—the armor elements of three heavy combined arms battalions. A possible fourth battalion of 36 armored vehicles appears to be missing its two tank companies.[37] In total, 640 military vehicles were present on 4 September 2022.

On 12 September 2022, three RO-RO ferries—BO HAI JING ZHU, BO HAI ZHEN ZHU, and ZHONG HUA FU XING—left their Bohai Gulf ferry routes and proceeded to Tianjin. The CHANG SHAN DAO and LONG XING DAO followed, arriving on 13 September. The RO-RO ferries proceeded in and out of port between two and four times each. Ten of the thirteen port visits ranged from 10-17 hours long. Ferries used the terminal's single RO-RO ramp or docked quayside. The ships then usually proceeded to the Tianjin anchorage for 12-48 hours before returning to the terminal.[38] Periodic satellite imagery of the port shows groups of vehicles missing during the exercise, presumably onboard ships at the anchorage. Figure 17 shows 80 vehicles missing as the ZHONG HUA FU XING arrived in port.

Figure 17. Tianjin International Cruise Ship Terminal, China, 16 September 2022 (© 2022 Planet)[39]

Figure 17 also shows armored vehicles driving out to the XINHAISHENG 8, probably to practice using the ship's loading ramp. It is not clear whether the ramp is standard equipment in the Chinese

[37] For a detailed description of PLAA operational and tactical units, see *Chinese Tactics*, ATP 7.100.3 (Washington, DC: Department of the Army, 2021), pp. 2-7 and 2-15, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN33195-ATP_7-100.3-000-WEB-1.pdf.

[38] AIS position data: BO HAI JING ZHU (MMSI 414095000), BO HAI ZHEN ZHU (MMSI 413409000), ZHONG HUA FU XING (MMSI 412283000), CHANG SHAN DAO (MMSI 412331000), and LONG XING DAO (MMSI 412900000), September 12-17, 2022, www.marinetraffic.com.

[39] Planet, SkySat, Image ID: 20220916_021654_ssc13_u0001, September 16, 2022, Tianjin, China, 38.975N, 117.820E, SkyWatch EarthCache, www.skywatch.com.

shipping industry or if it is even an innovation new to the PLA in 2022. This ramp was first noted on an unidentified deck cargo ship at Gulei Wharf (Fujian) in September 2021 (see Figure 18). Gulei Wharf is a known embarkation port for PLA amphibious training.[40]

Figure 18. Gulei, Fujian, 19 September 2021 (Google Earth/CNES-Airbus)

The general cargo ship CHANG ZAN appears on the left side of Figure 17, using its two 50-ton deck cranes to load or unload military vehicles from its cargo hold. The cargo ship SHENG TAI also likely participated in the loading exercise. SHENG TAI does not have deck cranes for self-loading and docked at the container port where large cranes were available, probably to facilitate the loading of military equipment or vehicles. SHENG TAI and CHANG ZAN went to and from the Tianjin anchorage twice during the exercise, probably with military vehicles onboard.[41]

During the Tianjin loading exercise, the RO-RO ferry BO HAI ZUAN ZHU was docked in the cargo port of Jingtang, 56 nautical miles (104 kilometers) northeast of Tianjin. BO HAI ZUAN ZHU left Jingtang only once, on 13 September 2022, and returned to port six hours later. Otherwise, the ferry remained in port for the five days of the exercise. Commercial satellite imagery was not available to confirm BO HAI ZUAN ZHU's activities, but the timing suggests that the ferry was probably also participating as a remote component of this military equipment loading exercise.

Assessment: Dedicating an entire heavy combined arms brigade to load and unload from RO-RO ferries and cargo ships for 3-4 weeks in lieu of other training indicates the importance the PLA likely places on these military lift exercises. This event is probably a three-fold expansion of a similar loading/unloading exercise held in October 2021 that involved three RO-RO ferries operating between Tianjin, Jingtang, and Qinhuangdao.[42] That loading exercise occurred at the end of the PLA's 2021 annual training cycle. This 2022 exercise also appears to be an end-of-cycle event. This five-day event exemplifies how a mix of civilian ships might be used to move non-amphibious, second echelon forces in a cross-strait invasion of Taiwan. With the exception of SHENG TAI possibly using port cranes for loading, this activity demonstrates a level of self-sufficiency necessary when using civilian ports for military operations. The event featured a cargo ship with cranes for self-

[40] Google Earth Pro 7.3.6.9285, September 19, 2021, Gulei, China, 23.769N 117.580E, CNES-Airbus 2022.

[41] AIS position data: SHENG TAI (MMSI 412081630) and CHANG ZAN (MMSI 413307520), September 12-17, 2022, www.marinetraffic.com.

[42] AIS position data: BO HAI MA ZHU (MMSI 414211000), ZHONG HUA FU XING (MMSI 412283000), and CHANG SHAN DAO (MMSI 412331000), October 13-20, 2021, www.marinetraffic.com.

loading, a deck cargo ship with a specially fitted ramp for self-loading, and RO-RO ferries conducting sustained loading/unloading operations with little more than a quay wall and staging area.

Section 4. Amphibious Landings and Logistics Over-the-Shore (LOTS)

Between May and September 2022, Chinese civilian ships participated in amphibious landing and LOTS exercises similar those observed during the 2021 PLA training cycle.[43] 2022 unit-level offshore landing training in the Southern Theater appeared to be half of what was observed in 2021. In contrast, 2022 training in the Eastern Theater featured extensive rehearsals for port-to-port LOTS training and experimentation with a new PLA floating causeway. The work with the new floating causeway started in May 2022 the way it had ended in September 2021, with the same two RO-RO ferries participating. 2022 activity culminated in an amphibious landing capstone exercise from 31 August-2 September 2022.

Port-to-Port Training and Experimentation with Floating Causeway

Activity: From late May through early July 2022, three RO-RO ferries participated in three separate training events in and around the Dacheng Bay Amphibious Training Area in eastern China. The RO-RO ferries BO HAI BAO ZHU, BO HAI ZHEN ZHU, and SHENG SHENG 2 probably moved troops and equipment between Gulei Wharf, east of Dacheng Bay, to Chaozhou Port, just west of Dacheng Bay (see Table 13 and Figure 19).

BO HAI ZHEN ZHU and SHENG SHENG 2 also engaged in several docking evolutions with SAN HAN GONG 8, a semi-submersible barge used as the stabilizing head of a floating causeway system.[44] These were the same two ships that participated in experimentation with the floating causeway system in September 2021. The PLA developed the causeway system to discharge non-amphibious wheeled and tracked vehicles from RO-RO ferries and possibly PLAN amphibious ships directly onto a beach. The modular system may extend more than 2,000 feet from a beach landing area, allowing ships with deep drafts to dock and offload without fear of running aground regardless of tidal variations in the landing area.

Table 13. Port-to-Port Training and Experimentation with Floating Causeway, 24 May-7 July 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
BO HAI BAO ZHU	渤海宝珠	BO HAI ZHEN ZHU	渤海珍珠
SHENG SHENG 2	生生 2	SAN HANG GONG 8	三航工 8
Ports and Amphibious Landing Areas			
Chaozhou Port	潮州港	Jiangyin Port	江阴港
Dacheng Bay (Landing Area)	大埕湾	Ningbo-Meixi RO-RO Terminal	宁波梅西滚装码头
Gulei Wharf	古雷码头	Xiamen Cruise Terminal	厦门邮轮码头

In each of the three events between May and July 2022, the RO-RO ferries moved from Gulei, a probable port of embarkation, to either the port of Chaozhou (Guangdong) or the floating causeway in Dacheng Bay. In Event 3, SHENG SHENG 2 and BO HAI ZHEN ZHU probably loaded exercise

[43] For an in-depth analysis of 2021 civil-maritime amphibious landing and LOTS training see, Dahm, "Chinese Ferry Tales," pp. 33-53.

[44] AIS position data: BO HAI BAO ZHU (MMSI 412330020), BO HAI ZHEN ZHU (MMSI 413409000), and SHENG SHENG 2 (MMSI 413328380), May 23-July 10, 2022, www.marinetraffic.com.

participants in Lianyungang and Ningbo respectively on their way to the exercise area. BO HAI BAO ZHU did not participate in Event 3.

- **Event 1: 26 May-1 June**
  - Five 1-hour docking events with floating causeway
- **Event 2: 15-20 June**
  - One 1-hour docking event with floating causeway
- **Event 3: 29 June-7 July**
  - One possible docking event with floating causeway

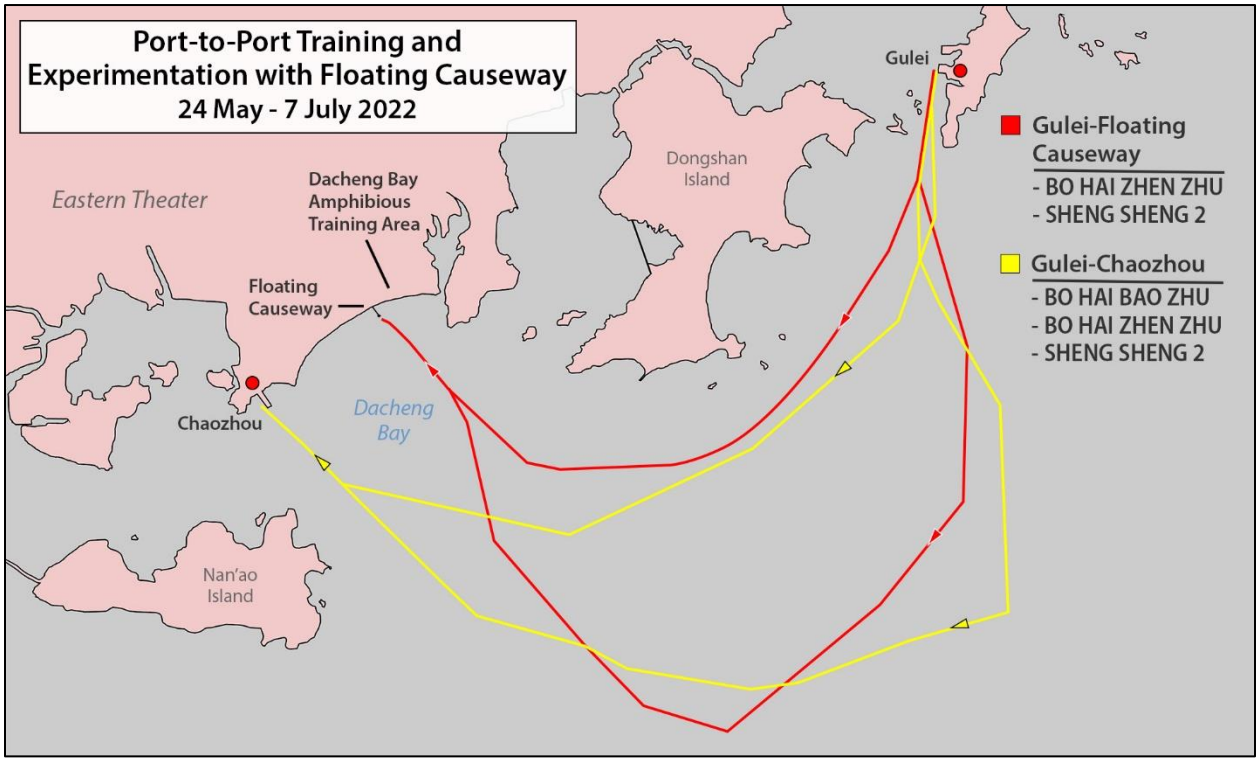

Figure 19. Port-to-Port Training and Experimentation with Floating Causeway, 24 May-7 July 2022

BO HAI ZHEN ZHU and SHENG SHENG 2 conducted all dockings with the SAN HANG GONG 8 positioned at the head of the floating causeway. SAN HANG GONG 8, a semi-submersible barge normally used in large port construction projects, deployed from Xiamen to Dacheng Bay from early-May through mid-July to work with the floating causeway.[45]

Assessment: The causeway system has undergone significant modifications since it was first seen in 2021. The new floating causeway system now consists of six uniform self-propelled sections that extend 2,130 feet (650 meters) from the shore. The previous system consisted of segments of different lengths and only reached 1,475 feet (450 meters) from the beach. Figure 20 shows the floating causeway assembled in Dacheng Bay. The SAN HANG GONG 8, seen on the edge of the image, maneuvers and attaches to the head of the causeway where it then docks with the RO-RO

[45] AIS position data: SAN HAN GONG 8 (MMSI 413378280), April 29-July 13, 2022, www.marinetraffic.com.

ships. Tugs are used to maneuver the semi-submersible barge and are normally present to assist with RO-RO ship docking.[46]

Figure 20. Dacheng Bay, China, 28 June 2022 (© 2022 Planet) [47]

The two RO-RO ferries that engaged in the 2022 floating causeway evolutions were the same ships that participated in the late September 2021 experimentation with the PLA's floating causeway system. Participating in the initial use of the floating causeway may indicate the SHENG SHENG 2 and BO HAI ZHEN ZHU crews helped the PLA develop procedures for its use. In the 2022 events, neither ship was docked with the SAN HAN GONG 8 for more than an hour, indicating that technical issues may have been resolved and the causeway system is approaching operational status. Still, the continued need for the semi-submersible barge to stabilize the causeway may limit its utility, especially if the system is required to deploy expeditiously across the Taiwan Strait.

The three 2022 port-to-port events were relatively fast paced compared to the large volume loading/unloading events outlined earlier in this report. Ferries only docked at each port for a few hours to load or unload. This set of events was likely used by PLA units to prepare and rehearse for the amphibious landing capstone exercise discussed later in this section. Commercial satellite imagery was not available for the short times the RO-RO ferries were in port to confirm the presence of military vehicles. However, this activity almost certainly involved moving troops and equipment, loading in Gulei and then rapidly unloading and deploying through Chaozhou. Offloaded vehicles probably returned to the Dacheng Bay amphibious training area. In the amphibious landing capstone exercise described at the end of this section, Gulei was clearly a port of embarkation and Chaozhou was a destination port.

Unit-Level Offshore Landing Training

Activity: From 7-21 July 2022, a single RO-RO ferry probably participated in unit-level offshore landing training at two amphibious training areas in the PLA's Southern Theater. Between 7-14 July, the CHANG SHAN DAO proceeded in and out of Maoming Port and lingered off the Qianhai amphibious training area for a total of six days, according to AIS data. The ship's maneuvers offshore indicate it may have engaged in the deployment of amphibious vehicles or assault boats. On 15 July, CHANG SHAN DAO proceeded to Honghai Bay where it lingered off the amphibious landing area for several days. The ship's maneuvers indicate it probably conducted two or three offshore launches of amphibious forces (see Table 14 and Figure 21).[48]

[46] For a detailed description of the floating causeway system and its development, see Dahm, "Chinese Ferry Tales," pp. 47-52.

[47] Planet, SkySat, Image ID: 20220628_022412_ssc12_u0001, June 28, 2022, Dacheng Bay, China, 23.612N, 117.180E, SkyWatch EarthCache, www.skywatch.com.

[48] AIS position data: CHANG SHAN DAO (MMSI 412331000), July 7-21, 2022, www.marinetraffic.com.

Table 14. Off-Shore Assault Training, 7-21 July 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
CHANG SHAN DAO	长山岛		
Ports and Amphibious Landing Areas			
Maoming Port	茂名港	Qianhai Bay (Landing Area)	前海湾
Qingdao Port	青岛港	Honghai Bay (Landing Area)	红海湾

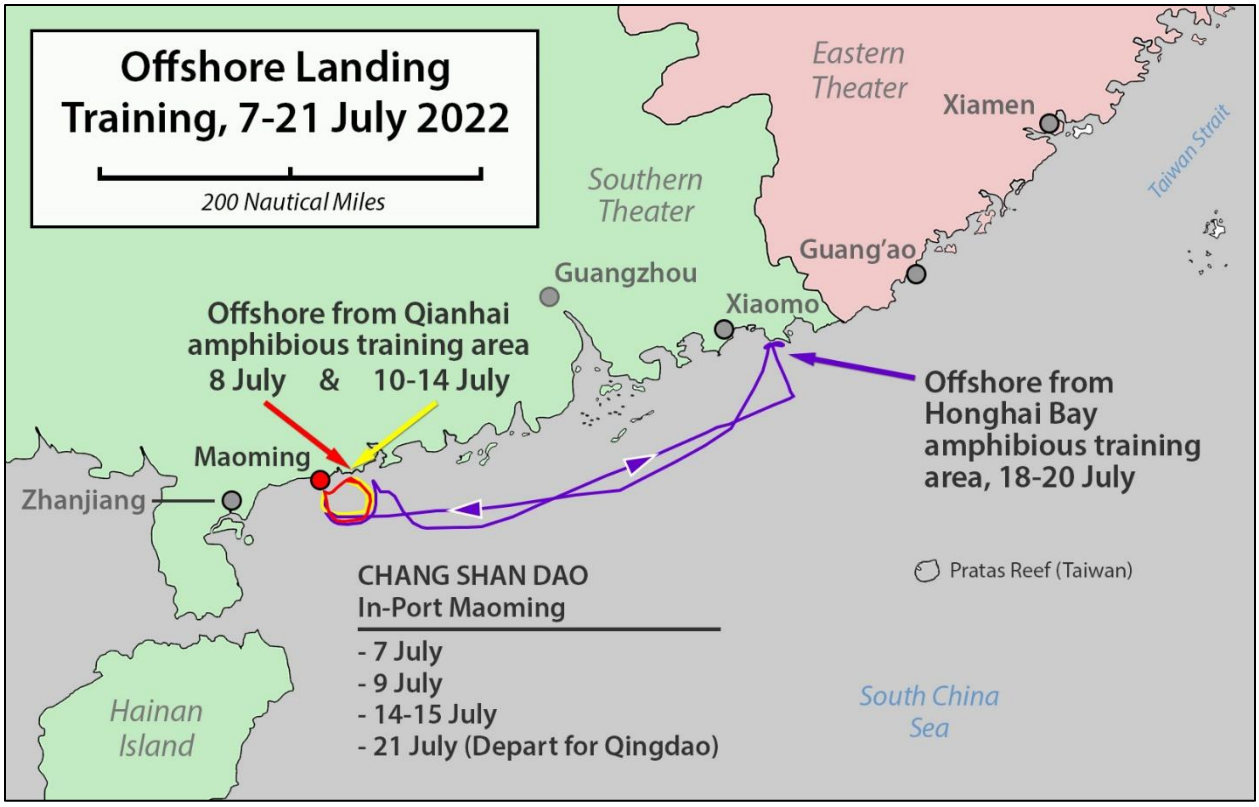

Figure 21. Offshore Landing Training, 7-21 July 2022

Following the offshore landing training, CHANG SHAN DAO proceeded north to Qingdao, where it apparently offloaded military vehicles and assault boats. Figure 22 shows the RO-RO ferry in Qingdao on 25 July 2022. The blue camouflage of what are probably amphibious armored vehicles indicates these are likely from a PLAN Marine Corps (PLANMC) unit.

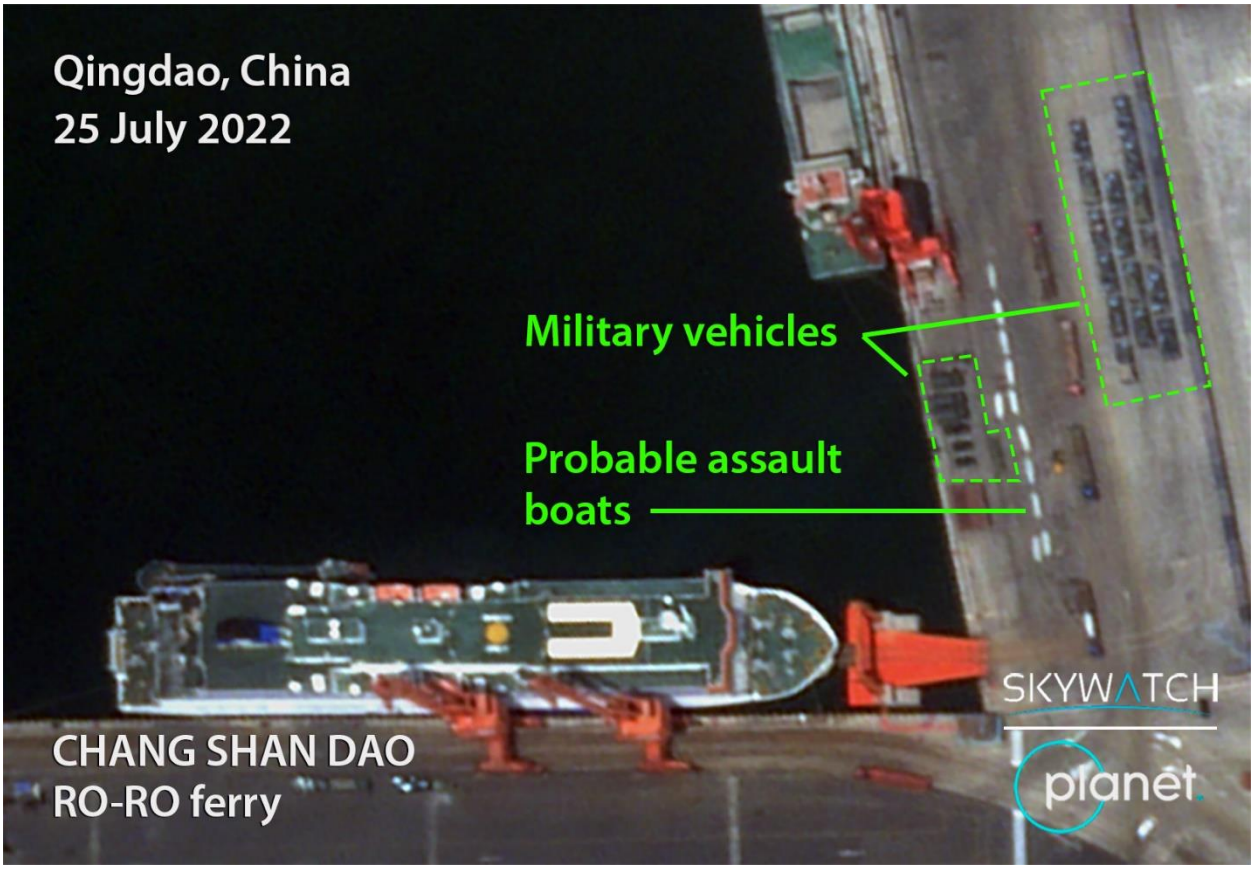

Figure 22. Qingdao, Shandong, 25 July 2022 (© 2022 Planet)[49]

Assessment: This offshore landing training with a probable PLANMC unit is almost identical to July-August 2021 unit-level PLANMC training events. The notable difference is that the 2022 event involved only one RO-RO ferry instead of the two that participated in 2021. The two ferries involved in the 2021 training also spent significantly more time offshore in Qianhai Bay, eighteen days versus the six days CHANG SHAN DAO spent at the same location. The 2022 landing training overlapped with the July-August large volume lift exercise, which may be responsible for the decrease in ships and time spent on this exercise compared to 2021.

Commercial satellite imagery of the 2022 exercise areas was not available to detail CHANG SHAN DAO's activities. However, it is very likely CHANG SHAN DAO engaged in the same training evolutions with embarked PLANMC as documented in the 2021 exercise. For a detailed analysis of the 2021 event, including details about the RO-RO ferries' offshore deployment of amphibious vehicles and assault boats, see China Maritime Report No. 16.[50]

Amphibious Landing Capstone Exercise
Activity: Ten civilian ships, including seven RO-RO ferries (all from the Bohai Ferry Group), one RO-RO vehicle carrier, and two general cargo ships, participated in a PLA amphibious landing exercise from 31 August-2 September 2022. The exercise also featured PLAN amphibious ships landing forces alongside the civilian ships in what was probably a capstone event for the 2022

[49] Planet, SkySat, Image ID: 20220725_024044_ssc1_u0001, July 25, 2022, Qingdao, China, 36.100N, 120.326E, SkyWatch EarthCache, www.skywatch.com.

[50] Dahm, "Chinese Ferry Tales," pp. 33-40.

training cycle. This three-day exercise involved two groups of civilian ships, designated here as the "north group" consisting of seven ships (see Table 15) and the "south group," consisting of three ships (see Table 16). Figures 23 and 24 provide a map and timeline of exercise events.

North Group. On 31 August, five civilian ships loaded PLA units at the Fujian Jiangyin International Container Terminal (Jiangyin). Figure 25 shows three RO-RO ferries probably preparing to load military vehicles at Jiangyin. Many vehicles waiting in columns are obscured by clouds, but BO HAI JING ZHU appears prepared to take on at least 78 vehicles, including amphibious armor. The image also appears to show the cargo ship CHANG ZAN with vehicles loaded into its cargo hold. The cargo ship SHENG TAI loaded at that same location later that day. The ferries BO HAI JIN ZHU and BO HAI MA ZHU arrived at Jiangyin to load on 1 September.

Table 15. Amphibious Landing Exercise North Group, 31 August-2 September 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships – Offshore Amphibious Landings			
BO HAI JING ZHU	渤海晶珠	BO HAI ZUAN ZHU	渤海钻珠
RO-RO Ships – LOTS (port-to-port or offload at floating causeway)			
BO HAI MA ZHU	渤海玛珠	BO HAI YU ZHU	渤海玉珠
BO HAI JIN ZHU	渤海金珠		
General Cargo Ships			
CHANG ZAN	长赞	SHENG TAI	盛泰
Ports			
Jiangyin Port	江阴港	Dacheng Bay (Landing Area)	大埕湾
Chaozhou Port	潮州港		

BO HAI YU ZHU, CHANG ZAN, and SHENG TAI proceeded to Dacheng Bay, arriving on 1 September. BO HAI JING ZHU and BO HAI ZUAN ZHU lingered south of Jiangyin before making their run to Dacheng Bay in the company of BO HAI JIN ZHU and BO HAI MA ZHU on 1 September. By the morning of 2 September, all the ships were in Dacheng Bay. Two RO-RO ferries, BO HAI MA ZHU and BO HAI YU ZHU, and the two cargo ships offloaded at the port of Chaozhou, west of the amphibious landing area. BO HAI JIN ZHU approached the beach and docked with the SAN HANG GONG 8 for approximately 90 minutes and probably offloaded vehicles onto the floating causeway. [51]

[51] AIS position data, BO HAI JING ZHU (MMSI 414095000), BO HAI ZUAN ZHU (MMSI 414210000), BO HAI JIN ZHU (MMSI 413305960), BO HAI MA ZHU (MMSI 414211000), BO HAI YU ZHU (MMSI 413408000), CHANG ZAN (MMSI 413307520), SHENG TAI (MMSI 412081630), August 30-September 2, 2022. www.marinetraffic.com.

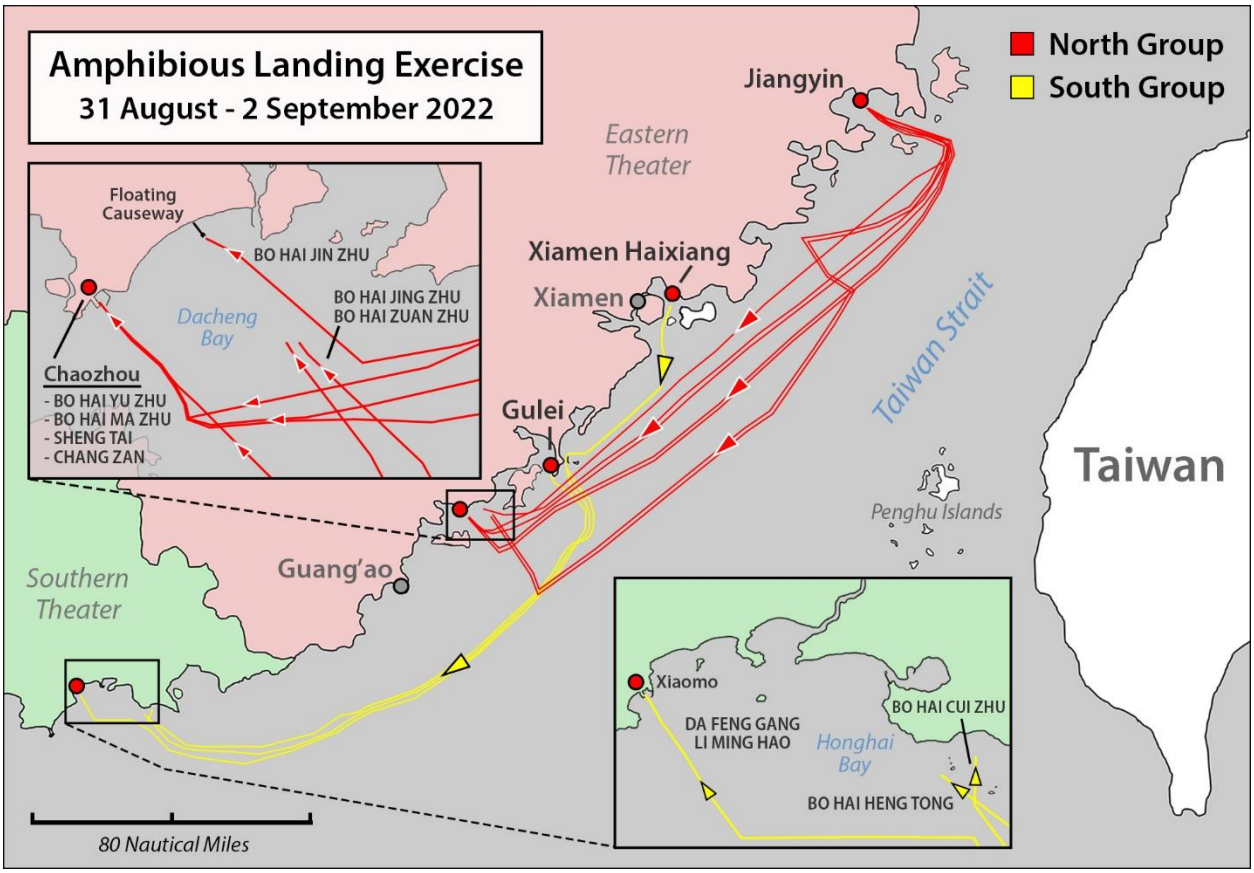

Figure 23. Amphibious Landing Exercise, 31 August-2 September 2022

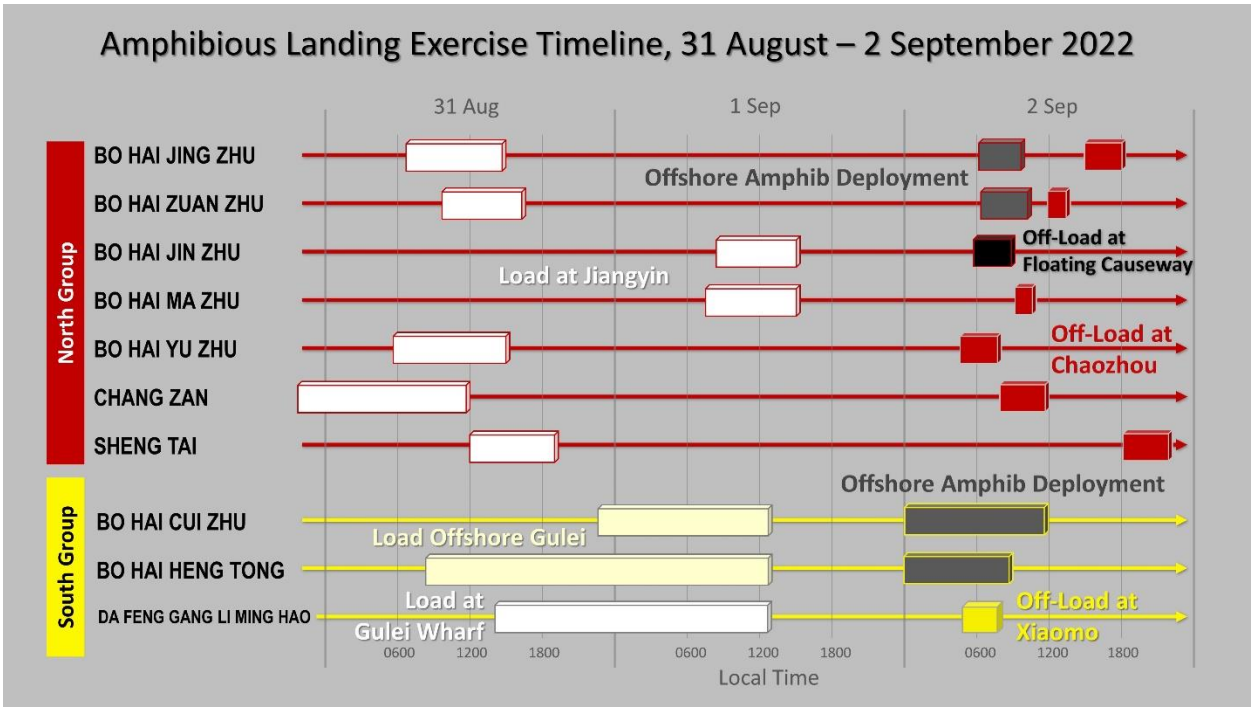

Figure 24. Amphibious Landing Exercise Timeline, 31 August-2 September 2022

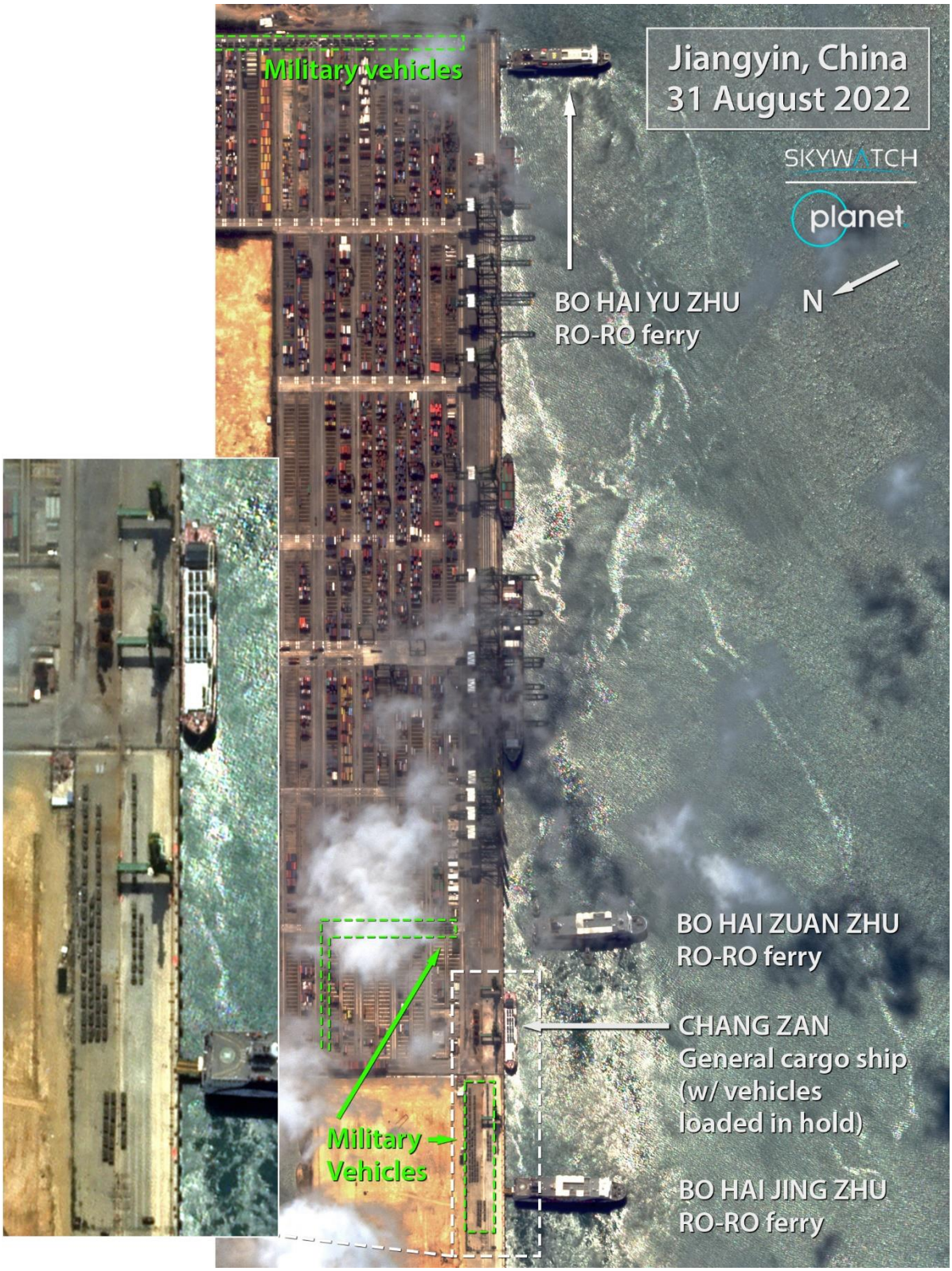

Figure 25. Jiangyin, Fujian, 31 August 2022 (© 2022 Planet)[52]

[52] Planet, SkySat, Image ID: 20220831_021646_ssc3_u0001, August 31, 2022, Jiangyin, China, 25.417N, 119.286E, SkyWatch EarthCache, www.skywatch.com.

Figure 26 shows the floating causeway at Dacheng Bay approximately 20 minutes after BO HAI JIN ZHU departed. Vehicles that may have been unloaded by BO HAI JIN ZHU could not be located elsewhere in the image, which raises questions as to whether any vehicles were offloaded at all. The causeway's six sections can be seen clearly in this image.

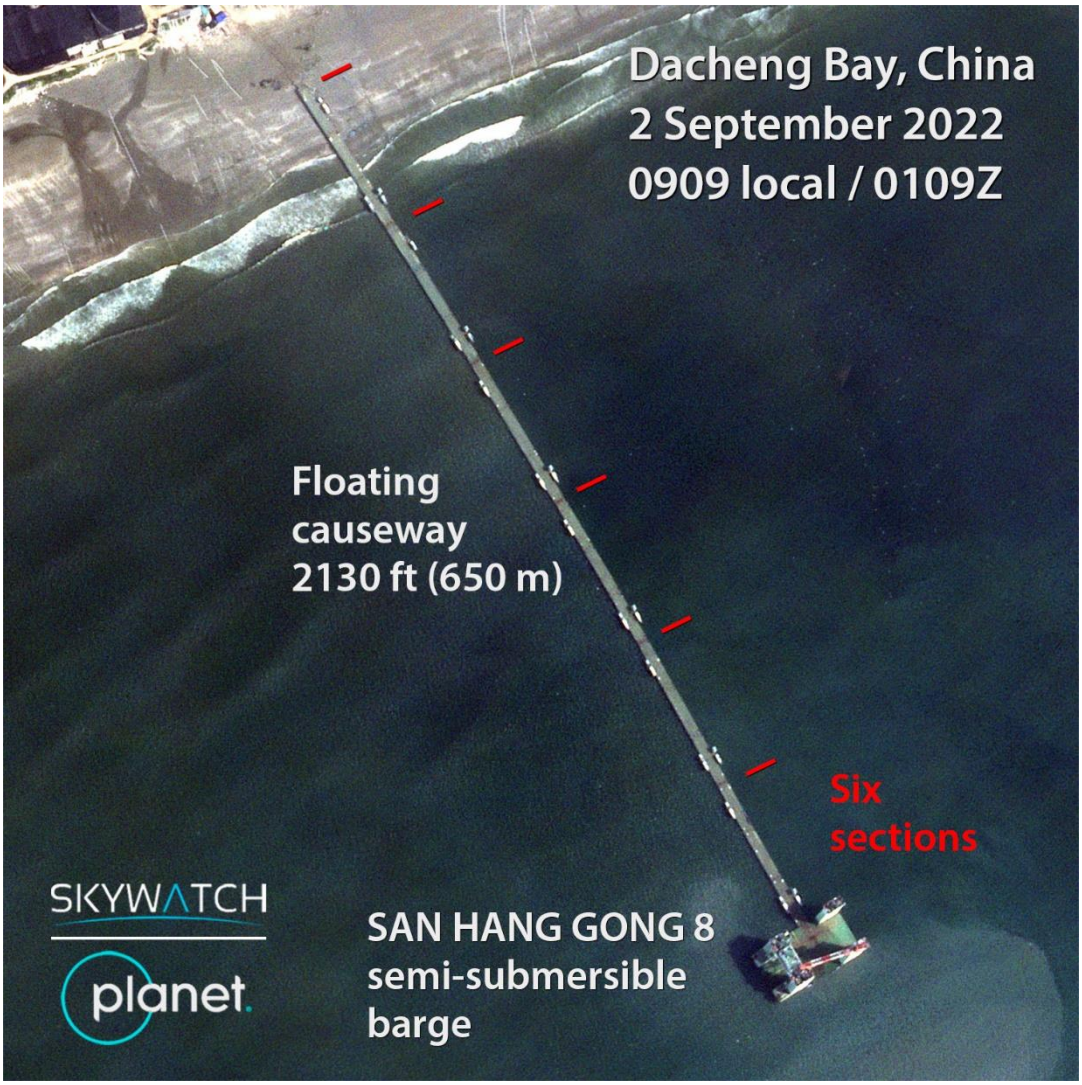

Figure 26. Floating Causeway at Dacheng Bay, 2 September 2022 (© 2022 Planet)[53]

While ships began unloading at the port of Chaozhou or at the causeway, BO HAI JING ZHU and BO HAI ZUAN ZHU took up position 6.5 nautical miles (12 kilometers) offshore at approximately 0700 local time on 2 September, where they probably began offloading amphibious vehicles into the water. By 0900 local time, amphibious vehicles were landing at the beach at Dacheng Bay. Figure 27 is a commercial satellite image taken at 0909 local time, in which amphibious vehicles can be seen landing as PLAN Type 271 utility landing craft (LCUs) make their way to the beach. It could not be determined whether the landing amphibious vehicles came from the RO-RO ferries. A medium resolution satellite image shows the RO-RO ferries offshore in the company of other ships with no

[53] Planet, SkySat, Image ID: 20220902_010932_ssc16_u0003, September 2, 2022, Dacheng Bay, China, 23.612N, 117.180E, SkyWatch EarthCache, www.skywatch.com.

AIS tracks. At least one is probably a PLAN Type 071 assault ship (LPD), based on its measurements.[54] After the two ferries offloaded amphibious vehicles offshore, each RO-RO proceeded to dock at Chaozhou, presumably to offload military logistics personnel and non-amphibious vehicles.

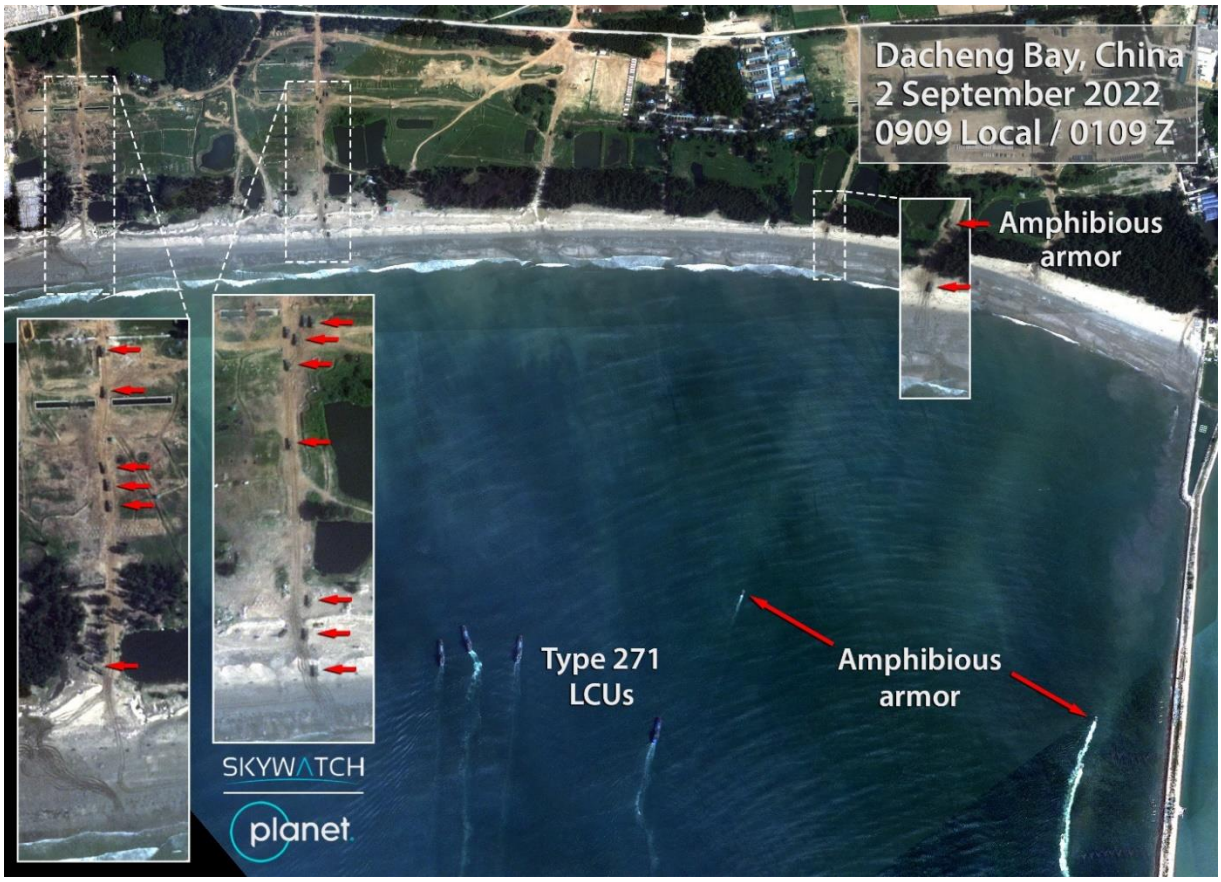

Figure 27. Dacheng Bay, 2 September 2022 (© 2022 Planet)[55]

Figure 28 is a high-resolution (30 centimeter) satellite image that shows the Dacheng Bay Amphibious Training Area on 3 September, the morning after the landings at Dacheng Bay and Chaozhou. 464 vehicles appeared since the landings began on 2 September. These include trucks, earthmovers, and other non-amphibious vehicles that may have landed at Chaozhou or via the floating causeway. The majority of vehicles appear to be amphibious armor. Probable wave deflectors, characteristic of amphibious tanks or the Type 05 amphibious fighting vehicle, can be seen on some vehicles as shown in the inset. The number of vehicles that had appeared since 2 September indicates that the unit transported by the RO-RO ferries and the other PLAN ships was possibly a PLAA amphibious combined arms brigade.[56]

[54] Planet, PlanetScope-SuperDove, Image ID: 20220902_023936_22_2403, Dacheng Bay, China, 23.527N, 117.256E, SkyWatch EarthCache, www.skywatch.com.

[55] Planet, SkySat, Image ID: 20220902_010932_ssc16_u0003, September 2, 2022, Dacheng Bay, China, 23.625N, 117.214E, SkyWatch EarthCache, www.skywatch.com.

[56] For a discussion of PLAA amphibious combined arms brigade composition, see, Dennis J. Blasko, "The PLA Army Amphibious Force: Missions, Organization, Capabilities, and Training," China Maritime Report No. 20, China Maritime Studies Institute, April 2022, p. 4, https://digital-commons.usnwc.edu/cmsi-maritime-reports/20.

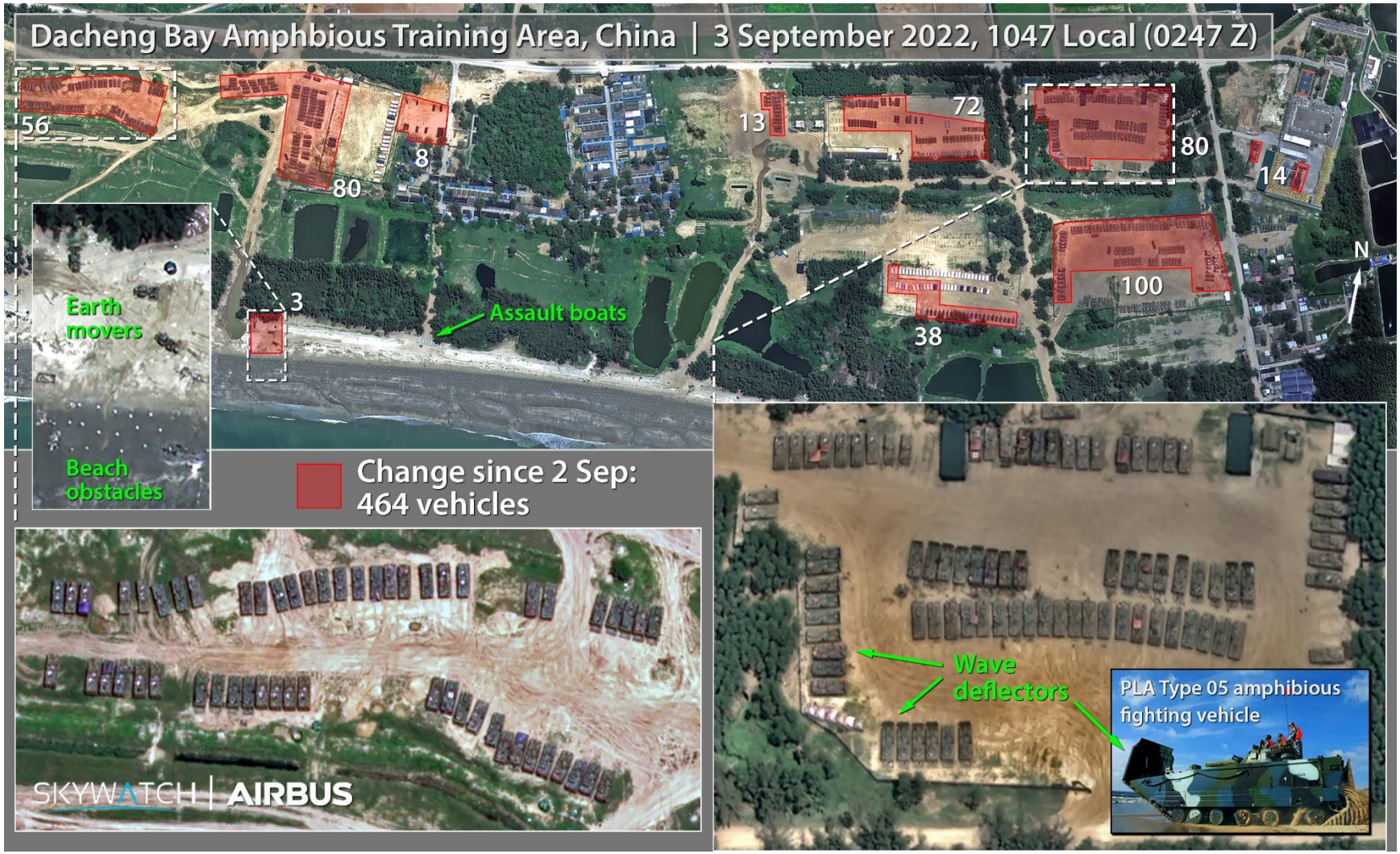

Figure 28. Dacheng Bay Amphibious Training Area, 3 September 2022 (© 2022 Airbus)[57]

[57] Airbus, Pleiades-Neo, Image ID: PNEO4_202209030247596_PMS-FS_ORT, September 3, 2022, Dacheng Bay, China, 23.625N, 117.214E, SkyWatch EarthCache, https://www.skywatch.com.

South Group. Between mid-day 31 August and mid-day 1 September, three civilian ships, two RO-RO ferries, and a RO-RO vehicle carrier probably loaded PLA amphibious units in the vicinity of Gulei, a peninsula just east of Dongshan Island and the Dacheng Bay amphibious training area (see Table 16). This activity was concurrent with north group loading activity at Jiangyin.

Table 16. Amphibious Landing Exercise South Group, 31 August-2 September 2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships – Offshore Amphibious Landings			
BO HAI CUI ZHU	渤海翠珠	BO HAI HENG TONG	渤海恒通
RO-RO Ships – LOTS (port-to-port)			
DA FENG GANG LI MING HAO	大丰港黎明号		
Ports			
Gulei Wharf	古雷码头	Honghai Bay (Landing Area)	红海湾
Xiaomo Port	小港港		

The RO-RO cargo ferry BO HAI HENG TONG and the RO-RO passenger ferry BO HAI CUI ZHU probably loaded amphibious armored vehicles at sea, about 800 yards (732 meters) off the eastern shore of the Gulei peninsula, according to AIS data. Maxar commercial satellite imagery of this area on 31 August 2022, analyzed by IHS Janes, showed the BO HAI HENG TONG offshore with its loading ramp extended in the company of swimming armored vehicles. As many as 153 amphibious armored vehicles, quite possibly the swimming elements of an amphibious combined arms battalion, were arrayed on the beach apparently waiting to load aboard the two ferries.[58] BO HAI HENG TONG probably loaded on the afternoon of 31 August before moving farther offshore. BO HAI CUI ZHU arrived in the loading area around midnight. Nighttime loading of amphibious vehicles cannot be ruled out, but the BO HAI CUI ZHU probably loaded amphibious vehicles after sunrise. The RO-RO vehicle carrier DA FENG GANG LI MING HAO arrived and docked on the western side of the peninsula at the Gulei Wharf on 31 August where it probably loaded military vehicles, possibly the non-amphibious elements of the combined arms battalion. DA FENG GANG LI MING HAO, in the company of the two RO-RO ferries, departed the Gulei area at 1300 local time on 1 September, and proceeded south toward Honghai Bay.[59]

By 0200 local time on 2 September 2022, the RO-RO ferries stopped in Honghai Bay between 2-3 nautical miles (4-5.5 kilometers) off the landing beach where they remained for several hours. From their stationary positions, the two ships probably offloaded amphibious vehicles that then swam into the Honghai Bay amphibious training area. BO HAI HENG TONG departed Honghai Bay at 1030 local; BO HAI CUI ZHU departed at 1400 local. Unlike the north group ships, neither of these RO-RO ferries called in a nearby port following their offloads. They proceeded back to their normal ferry routes without stopping, indicating they had probably arrived in Gulei empty, onloaded and offloaded exercise forces, and departed the exercise empty. The DA FENG GANG LI MING HAO arrived at the Xiaomo International Logistics Port (Xiaomo) at 0700 local time and docked for three hours, probably offloading the vehicles it had taken on in Gulei.[60]

[58] Christopher Biggers, "Analysis: PLA conducts amphibious exercises near Taiwan," *Janes Defence Weekly*, September 21, 2022, www.janes.com.

[59] AIS position data: BO HAI HENG TONG (MMSI 413244930), BO HAI CUI ZHU (MMSI 414096000), and DA FENG GANG LI MING HAO (MMSI 413239310), August 31 – September 1, 2022, www.marinetraffic.com.

[60] AIS position data: BO HAI HENG TONG (MMSI 413244930), BO HAI CUI ZHU (MMSI 414096000), and DA FENG GANG LI MING HAO (MMSI 413239310), September 1-2, 2022, www.marinetraffic.com.

Assessment: The 2022 amphibious landing capstone exercise was very similar to, but somewhat more complex than the September 2021 landing exercise. The 2022 exercise involved ten civilian ships compared to eight involved the year before. The number of ships involved in port-to-port operations, including the one port-to-floating causeway operation—six—remained the same. The notable difference was adding two RO-RO ferries for offshore landing operations and splitting the force into a north and south group.

The tracks of the ships indicate that threats or opposition forces were likely not considered in the exercise. The north group ships appeared to move independently of one another, some proceeding to the exercise area and anchoring offshore a day prior to landing while others showed up in the exercise area the morning of 2 September 2022. The south group proceeded to the exercise area together, but there was no apparent effort to sail in a convoy. Maintaining a tight convoy formation may be useful, especially if the ships are escorted by a navy combatant. A PLAN ship could provide air defense coverage or protection against submarine or surface threats, provided the merchant ships stayed close to their potential escort and were not as spread out as they were during this transit.

While north group ships BO HAI JING ZHU and BO HAI ZUAN ZHU were positioned 6.5 nautical miles (12 kilometers) offshore to offload, presumably to honor any coastal threats, they nevertheless remained in the same position for over four hours, increasing their vulnerability. South group RO-ROs were closer in, offloading 2-3 nautical miles (4-5.5 kilometers) offshore, but also remained stationary for two hours. RO-RO ferries have yet to display more sophisticated amphibious tactics like rapid offloads at sea or offloading from their stern ramps while underway. This may indicate that, at least for the moment, RO-RO ferries are intended for delivering second echelon amphibious forces and would not participate in an initial amphibious assault. The south group RO-RO ferries loading offshore may demonstrate that civilian ships could be used in a large-scale amphibious operation to reposition forces along the Taiwan coast, moving them from one beachhead to a different landing area with no dependence on port infrastructure.

The objective of this exercise appeared to be simply putting PLA forces ashore. Commercial satellite imagery was not available to indicate what activities, if any, the amphibious combined arms brigade conducted immediately after landing on 2 September. However, 24 hours after coming ashore, the force was administratively parked at the training facility rather than tactically deployed across the countryside.

The 2022 amphibious landing capstone exercise appears to have culminated on 2 September, but there is a possibility that follow-on exercise activity was cut short by weather. Typhoon Hinnamnor moved across the East China Sea toward the Chinese coast 1-5 September 2022. Immediately after the 2 September landings, some RO-RO ferries quickly transited north, returning to the Bohai Gulf ahead of the storm's track. Other ships anchored near Xiamen to wait for the storm to pass north before returning to the Bohai several days later. In any case, no civilian ship participation in PLAN amphibious exercises were observed after 2 September 2022.

Section 5. South China Sea Logistics Support

An examination of AIS data and commercial satellite imagery from October 2021-September 2022 revealed four civilian ships providing military logistics support to PLA island outposts in the South China Sea. The RO-RO cruise ships CHANG LE GONG ZHU and QI ZI WAN appeared to move military vehicles between Yulin Naval Base to Woody Island in the Paracel Islands. The general cargo ships CHANG XIONG and CHANG ZAN were also identified as providing routine logistical support to the major PLA island-reef outposts in the Spratly Islands in the southern reaches of the South China Sea.

Woody Island Logistics Support

Activity: In January and June 2022, the RO-RO ship CHANG LE GONG ZHU provided military transportation between Hainan Island's Yulin Naval Base and Woody Island in the northern South China Sea. Figure 29 shows the ship loading military vehicles at Yulin Naval Base in January 2022. Figure 30Figure *30* shows the ship loading at Yulin Naval Base on 12 June and then in port Woody Island the next day. In August 2022, QI ZI WAN, another RO-RO cruise ship, also likely transported military equipment from Yulin Naval Base to Woody Island.[61]

Table 17. Woody Island Logistics Support, 2021-2022

Name	Name (Chinese)	Name	Name (Chinese)
RO-RO Ships			
CHANG LE GONG ZHU	长乐公主	QI ZI WAN	棋子湾
Ports			
Woody Island (Yongxing Dao)	永兴岛	Yulin Naval Base	榆林海军基地

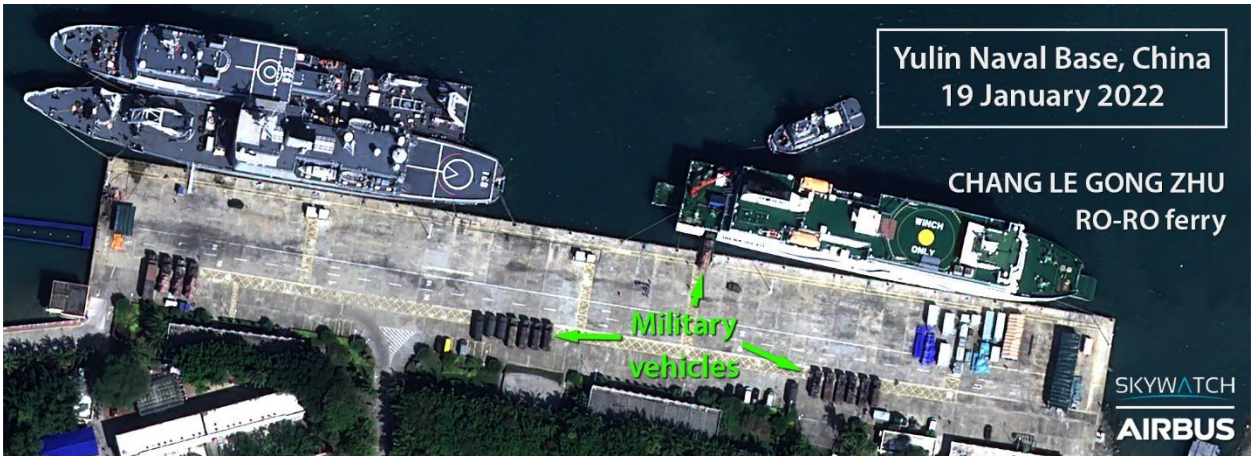

Figure 29. CHANG LE GONG ZHU at Yulin Naval Base, Hainan, 19 January 2022 (© 2022 Airbus)[62]

[61] AIS position data: CHANG LE GONG ZHU (MMSI 413526230), January 17-19 and June 12-14, 2022; and QI ZI WAN (MMSI 413895000), July 14-17, 2022, www.marinetraffic.com.

[62] Airbus, Pleiades-Neo, Image ID: PNEO4_202201190322498_PMS-FS_ORT, January 19, 2022, Yulin Naval Base, China, 18.221N, 109.537E, SkyWatch EarthCache, https://www.skywatch.com.

Figure 30. CHANG LE GONG ZHU in Yulin Naval Base and Woody Island, 12-13 June 2022 (© 2022 Planet)[63]

Assessment: This is likely the first open-source observation of RO-RO ships providing service from a PLAN base to Woody Island. Civil logistics support to Woody Island is routinely provided by at least two RO-RO passenger-cargo ships operated by the Hainan Island or Sansha City municipal government. The SAN SHA 1 (三沙 1 号, MMSI: 413524070) and SAN SHA 2 (三沙 2 号, MMSI: 413214690) provide service from Hainan's Wenchang port to Woody and other Paracel Islands. They have reportedly provided transportation for PLA troops and vehicles in the past.[64]

The RO-RO cruise ships CHANG LE GONG ZHU and QI ZI WAN are owned and operated by China Ocean Shipping Company (COSCO) subsidiary Hainan Strait Shipping Co., Ltd.[65] These ships normally provide "eco-tourism" cruises to the Paracel Islands. The ships' RO-RO ramps offer opportunities to launch small boats or access reefs directly. Since 2020, tourist cruises have been suspended due to the COVID-19 pandemic. These military logistics events may simply represent an opportunity for the PLA and the shipping company to benefit from the use of these underemployed vessels. According to AIS data, these two ships have also probably supported PLA movements to several other Southern Theater ports during the reporting period.[66] In April 2022, another South China Sea cruise ship, the NAN HAI ZHI MENG (南海之梦), was utilized for long-haul transportation from the southern port of Maoming (Guangdong) to Dalian.[67] This unusual voyage for a South China Sea cruise ship may also have been in support of the PLA.

Spratly Island Logistics Support

Activity: According to AIS data, the general cargo ship CHANG XIONG provided dedicated logistics support to the PLA's South China Sea artificial island bases throughout 2021 and 2022.

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[63] Planet, SkySat, Image ID: 20220612_055104_ssc19_u0001, June 12, 2022, Yulin Naval Base, China, 18.221N, 109.537E and 20220613_023830_ssc4_u0001June 13, Woody Island, 16.828N, 112.336E, SkyWatch EarthCache, https://www.skywatch.com.

[64] 中国三沙 1 号轮运行一周年 ["First Anniversary of China's Sansha 1 Shipping Operation"], 观察者网 [*Observer Network*], January 11, 2016, http://mil.news.sina.com.cn/china/2016-01-11/doc-ifxnkkuv4347338.shtml.

[65] 2022 年半年度报告 [*2022 Semi-Annual Report*], 海南海峡航运股份有限公司 [Hainan Strait Shipping Co., Ltd.], August 25, 2022, p. 145, http://static.cninfo.com.cn/finalpage/2022-08-25/1214390203.PDF.

[66] AIS position data: CHANG LE GONG ZHU (MMSI 413526230), April 14-17 and May 23-26, 2022; and QI ZI WAN (MMSI 413895000), October 19-24, 2021, and April 15-20, May 12-18, July 4-8, July 24-28, August 12-15, 2022, www.marinetraffic.com.

[67] AIS position data: NAN HAI ZHI MENG (MMSI 412237000), April 13-26, 2022, www.marinetraffic.com.

Every three to four weeks, the CHANG XIONG called at the Nansha Container Terminal, south of Guangzhou, and proceeded to each of the PLA's major artificial islands—Subi Reef, Fiery Cross Reef, and Mischief Reef. The CHANG XIONG's sister ship, CHANG ZAN, also visited the island-reefs, apparently providing cargo services between Woody Island and the Spratly outposts in April and May 2022. Figure 31 shows these ships transloading cargo and containers at Subi and Mischief Reefs.[68]

Table 18. Spratly Logistics Support, 2021-2022

Name	Name (Chinese)	Name	Name (Chinese)
General Cargo Ships			
CHANG XIONG	长(長)富	CHANG ZAN	长赞
Ports			
Fiery Cross Reef (Yongshu Jiao)	永暑礁	Subi Reef (Zhubi Jiao)	渚碧礁
Mischief Reef (Meiji Jiao)	美济礁	Woody Island (Yongxing Dao)	永兴岛
Nansha Container Terminal	南沙集装箱码头		

Figure 31. CHANG ZAN at Mischief Reef, 23 March 2022, and CHANG XIONG at Subi Reef, 9 May 2022 (© 2022 Planet and © 2022 Google Earth/Maxar)[69]

Assessment: This is the first open-source identification of cargo ships providing logistics support to the PLA's South China Sea artificial islands. CHANG XIONG's only voyages in 2022 were to provide services to the South China Sea islands. As outlined elsewhere in this report, in addition to the April and May 2022 South China Sea voyages, CHANG ZAN participated in numerous other military events throughout 2022. Both cargo ships may have been dedicated full-time to PLA logistics and exercise support.

[68] AIS position data: CHANG XIONG (MMSI 413380840), October 1, 2021-September 30, 2022; and CHANG ZAN (MMSI 413307520), March 16-April 30, 2022; www.marinetraffic.com.

[69] Airbus, Pleiades, Image ID: DS_PHR1A_202203230241303_FR1_PX_E115N09_0722_01636, March 23, 2022, Mischief Reef, 9.925N, 115.531E, SkyWatch EarthCache, https://www.skywatch.com. Google Earth Pro 7.3.6.9285, May 9, 2022, Subi Reef, 10.938N 114.085E, Maxar Technologies 2022.

Conclusion

This report represents a first attempt to use open and commercial sources to comprehensively examine Chinese civil maritime-military activity throughout a training year. A total of 38 civil maritime-military events were observed between October 2021 and September 2022, with twelve categorized as "significant events," involving multiple ships in coordinated activities. Three major exercises also occurred at the end of the reporting period: two large volume lift exercises and an amphibious landing exercise.

Thirty-six Chinese civilian ships spent a combined total of 744 ship-days in support of PLA activities during the reporting period. Large, ocean-going RO-RO ferries that have been built to national defense standards appeared to provide the majority of logistics and exercise support to the PLA. Eighteen large RO-RO ferries were involved in different events throughout the year, representing 58 percent of the Chinese fleet of 31 large, ocean-going RO-RO ferries available. Thirty-seven ports and terminals were also identified as supporting Chinese military activities in 2022.

During the annual military training cycle that ran through September 2022, the PLA appeared to make notable progress in its use of civilian ships for military lift. However, this report assesses that the PLA and its reserve civilian merchant fleet are still probably unable to provide significant amphibious landing capabilities or the maritime logistics in austere or challenging environments necessary to support a large-scale, cross-strait invasion of Taiwan. That said, if the increases in the quality and volume of training since 2020 represents a trend that continues, the PLA may be able to effectively leverage civil maritime shipping on a large enough scale to support a major amphibious operation sometime in the next five to ten years.

While the PLA has clearly begun to address noted deficiencies in capacities, observed exercises took place under very controlled conditions in Chinese ports. Most of the lift capacity in the PLA's large-volume lift exercise was from eight of the thirty-one available ocean-going RO-RO ferries (26 percent). The numbers of military vehicles and personnel that were possibly moved during this and other exercises were generated largely through slow, methodical activity spread out over days or weeks. Adding additional ships and significantly increasing the operational tempo of these exercises would more realistically represent what would be required for a major undertaking like a large-scale, rapidly unfolding cross-strait invasion.

2022 exercises did not appear to represent enemy threats, damage and sabotage of ports, or other challenges that would likely manifest in real-world, opposed port-to-port lift operations. Similarly, enemy threats did not appear to be represented in amphibious landing exercises that featured the use of civilian RO-RO ferries to offload amphibious forces at sea. While more complex and fast-paced than years past, these exercises still occurred in ideal weather conditions with ferries anchored offshore for several hours at a time, discharging amphibious vehicles into relatively calm waters.

Most large exercises observed in 2022 appeared to focus on moving second echelon forces. Individual events ultimately ended with an offload in a port or, in some cases, with an offshore deployment of amphibious vehicles. Once offloads were complete, PLA forces involved did not appear to engage in other activity consistent with what might be expected in a cross-strait invasion exercise. That is, the PLA ground units did not appear to move toward a military objective or tactically deploy as they might in the face of enemy forces. In most cases, PLA forces simply remained in ports, probably to be reloaded on ships for more logistics training or, in the case of the amphibious landing exercise, simply assembled at the training facility adjacent to the beach landing area.

A number of PLA activities have been reported for the first time in this year-long study based on open and commercial sources. While not previously observed in other public reporting, it is possible these activities were not necessarily new activities for the PLA in 2022. These include a probable large-scale lift of military vehicles using ten smaller RO-RO ferries, the use of large RO-RO ferries to move units up-river to inland ports, and the use of civilian port infrastructure to conceal the movement and loading of military vehicles.

Few innovations were noted in 2022 exercise activity compared to past years. The deck cargo ship loading ramp seen in the September 2022 Tianjin loading exercise may have been an innovation, but there are unconfirmed indications this type of ramp was used by the PLA during 2021 exercises. The PLA's floating causeway system continues to undergo modifications, extending its reach from the shoreline, but the causeway is probably not yet operational. The system only saw limited use in 2022 exercises and may still be facing technical challenges. An over-the-shore capability like the floating causeway will be a critical capability in a Taiwan invasion giving the PLA the capability to bypass damaged or sabotaged ports and harbors with an independent, relocatable off-shore loading and unloading capability.

As of 2022, a near-term full-scale invasion of Taiwan would be an extraordinarily high-risk and probably high-loss endeavor for the PLA. However, the PLA showed progress in 2022 toward reducing risk and potential losses by developing procedures and increasing proficiency using civilian ships for logistics and landing operations. In the short-term, the PLA may be able to leverage civilian shipping in any number of smaller scale logistics and landing operations in a Taiwan contingency (e.g., the seizure of Taiwan's offshore islands). These civil maritime-military capabilities could also be leveraged against other foreign military objectives or in domestic or foreign disaster relief operations. In the longer-term, probably at least beyond 2027, the PLA will need to continue development of its civil maritime-military capabilities concurrent with other necessary military capabilities that might support a full-scale invasion of Taiwan.

Appendix A. Chinese Merchant Ships Supporting Civil-Military Activity

Tables 19-24 list ships owned, operated, or managed by companies that have been observed through open-sources and commercial sources providing logistics support to the PLA or participating in Chinese military exercises since at least 2020. Ship data provided includes:

- **MMSI** – Maritime Mobile Service Identity number / Automatic Identification System (AIS) number.
- **IMO** – International Maritime Organization number.
- **Gross Tonnage** – A calculated measurement of a ship's internal volume where a vessel "ton" is 100 cubic feet.
- **Deadweight Tonnage (DWT) –** Number of metric tons (1000 kg/2204 lbs) of cargo, stores, and fuel a vessel can transport.
- **Vehicles –** "Vehicle" numbers provided by RO-RO ferry companies or ship manufacturers probably refer to a mix of cars and trucks. For vehicle carrier ships, this is assumed to refer to a car equivalent unit (CEU), 4 meters by 1.5 meters. A ship's military vehicle capacity, including heavy armor and oversized vehicles, is likely less than advertised vehicle numbers.
- **Lanes in Meters (LIM) –** A measurement of a RO-RO ship's vehicle lanes, conventionally with a 2-meter-wide lane. (1 LIM = 2 square meters, 2000 LIM = 4000 square meters of vehicle deck space).

The civil maritime industry is organized around an often-complex array of owners, managers, joint ventures, and front companies. Broadly, merchant ships that have been noted supporting the PLA fall into three categories, 1) RO-RO ferries owned by the publicly traded Bohai Ferry Group corporation, 2) a single cargo ship owned by the privately held Qingdao Old Captain Shipping Company (FU YUN 828), and 3) those ships that are ultimately owned by large Chinese SOEs such as the China Ocean Shipping Company (COSCO) or China Merchants Group. This appendix delineates subsidiary companies and managers that appear to be directly responsible for day-to-day operations of ships noted supporting civil maritime-military activity in 2022.

Ships supporting civil maritime-military activity are probably paid for their participation through charter contracts. Most of these ships also likely enjoy some legal protections as members of the Maritime Militia. Bohai Ferry Group ships are organized into the Militia's "Eighth Transport Dadui" (海运八大队).[70] The China Merchants vehicle carriers reportedly constitute the "Fifth Transport Dadui" (海运五大队). RO-RO ferries servicing Hainan Island may constitute the "Ninth Transport Dadui" (海运九大队).[71]

[70] 全国国防动员工作先进个人颁奖仪式在烟台举行 ["National Defense Mobilization Advanced Individual Award Ceremony Held in Yantai"], 渤海轮渡集团股份有限公司 [Bohai Ferry Group], July 4, 2020, http://www.bhferry.com/e/action/ShowInfo.php?classid=11&id=81.

[71] Conor M. Kennedy, "Getting There: Chinese Military and Civilian Sealift in a Cross-Strait Invasion," in *Crossing the Strait: China's Military Prepares for War with Taiwan,* Joel Wuthnow, Derek Grossman, Phillip C. Saunders, Andrew Scobell, and Andrew N.D. Yang, eds. (Washington, DC, National Defense University, 2022), p. 234. https://ndupress.ndu.edu/Portals/68/Documents/Books/crossing-the-strait/crossing-the-strait.pdf.

RO-RO Ships – Bohai Gulf Ferry Routes

Over two dozen roll-on/roll-off passenger (ROPAX) ferries provide regular service across the mouth of China's Bohai Gulf. All of these large ocean-going vessels have at least two vehicle decks. They also have external doors that close and seal to create a high-water line, increasing their ability to operate safely in heavy seas. Different classes of RO-RO ferries are shown in Figure 32.

Bohai Ferry Group – Bohai Ferry Group Co. Ltd. (渤海轮渡集团股份有限公司) and its subsidiaries own and operate seventeen RO-RO ferries across the Bohai Gulf. ROPAX ferries fall directly under the Bohai Ferry Group. The oldest RO-RO ferries, BO HAI MING ZHU and BO HAI JIN ZHU, provide cargo service under the subsidiary Tianjin Bohai Ferry Shipping Co., Ltd. (天津渤海轮渡航运有限公司). Purpose-built RO-RO cargo ferries BO HAI HENG TONG and BO HAI HENG DA are owned by Bohai Hengtong Ferry Co., Ltd. (渤海恒通轮渡有限公司), a joint venture company between Bohai Ferry Group, Hengtong Logistics Corporation, and Longkou Port Group. In 2020, Bohai Ferry Group acquired Weihai Haida Passenger Transport Co., Ltd. (威海市海大客运有限公司) and its RO-RO ferries.[72] Weihai Haida's SHENG SHENG 1 was inactive throughout 2022 and is likely at the end of its service life. ZHONG HUA FU QIANG suffered a serious fire in its vehicle bay in April 2021. The ZHONG HUA FU QIANG had not returned to service by late 2022. Bohai Ferry Group ships are listed in Table 19.

COSCO Shipping – The China Ocean Shipping Co., Ltd. is a large Chinese SOE. The COSCO subsidiary COSCO Shipping Ferry Co., Ltd. (中远海运客运有限公司) owns and operates twelve ocean-going ferries that provide service across the Bohai Gulf.[73] In 2022, COSCO Ferry Shipping took delivery of the SHUN LONG HAI, a purpose-built RO-RO cargo ferry similar to Bohai Hengtong Ferry cargo ferries. A second RO-RO cargo ferry, SHUN LONG HAI's sister ship, should be delivered in 2023.[74] COSCO Shipping (Qingdao) Co., Ltd. (中远海运(青岛)有限公司) operates a Chinese-flagged ROPAX ship that sailed between Yantai, China and Incheon, South Korea throughout 2022.[75] COSCO Ferry ships are listed in Table 20.

[72] Bohai Ferry Group Co., Ltd., 2021 年年度报告 [*2021 Annual Report*], March 29, 2022, pp. 10-11. http://static.cninfo.com.cn/finalpage/2022-03-30/1212725160.PDF

[73] 船舶风采 ["Ship Style"], COSCO Shipping Ferry Co., Ltd., accessed 10 October 2022, https://ferry.coscoshipping.com/col/col6772/index.html.

[74] 公司隆重举行 "顺龙海" 轮首航仪式 ["The Company Grandly Held the Maiden Voyage Ceremony of 'Shunlonghai'"], COSCO Shipping Ferry, Co., Ltd., September 23, 2022, https://ferry.coscoshipping.com/art/2022/9/23/art_6760_283155.html.

[75] "新香雪兰" 轮成功命名交付! ["'Xinxiang Xuelan' Successfully Delivered and Named!"], COSCO Shipping (Qingdao) Co., Ltd., December 11, 2020, https://qd.coscoshipping.com/art/2020/12/11/art_17685_183954.html.

1. BO HAI BAO ZHU

2. BO HAI ZUAN ZHU

3. ZHONG HUA FU XING

4. BO HAI HENG DA

5. SHENG SHENG 2

6. BANG CHUI DAO

7. CHANG SHAN DAO

8. JI LONG DAO

9. SHUN LONG HAI

Figure 32. RO-RO Ships on Bohai Gulf Ferry Routes[76]

[76] Images: 1-4 – Bohai Ferry Group (www.bhferry.com); 5 – Wikimedia Commons (https://commons.wikimedia.org/wiki/File:生生 2 号_威海海大客运有限公司.jpg); 6-9 – COSCO Shipping Ferry Co. (https://ferry.coscoshipping.com).

Table 19. Bohai Ferry Group RO-RO Ships (Bohai Gulf Routes)[77]

2020	2021	2022	Name	Name (Chinese)	MMSI	IMO	Year Built	Gross Tonnage	DWT	Length (ft/m)	Beam (ft/m)	Draft (ft/m)	Passengers	Vehicles	LIM (m)
Bohai Ferry Group Co., Ltd. (渤海轮渡集团股份有限公司)															
			BO HAI YIN ZHU	渤海银珠	412328370	9486221	2007	19847	6984	528/161	79/24	20/6	-	300	1800
			BO HAI YU ZHU	渤海玉珠	413408000	9508330	2009	24024	7535	538/164	82/25	20/6	1571	300	1993
			BO HAI ZHEN ZHU	渤海珍珠	413409000	9508328	2009	24024	7535	538/164	82/25	20/6	1571	300	1993
			BO HAI BAO ZHU	渤海宝珠	412330020	9508342	2010	24024	7618	538/164	82/25	20/6	1571	300	1993
			BO HAI FEI ZHU	渤海翡珠	413324830	9508366	2010	24024	7592	538/164	82/25	20/6	1571	300	1993
			BO HAI CUI ZHU	渤海翠珠	414096000	9584803	2012	34222	7587	587/179	92/28	20/6	2038	300	2500
			BO HAI JING ZHU	渤海晶珠	414095000	9584815	2012	34222	7598	587/179	92/28	20/6	2038	300	2500
			BO HAI MA ZHU	渤海玛珠	414211000	9723461	2015	33458	7503	587/179	92/28	20/6	2038	300	2500
			BO HAI ZUAN ZHU	渤海钻珠	414210000	9713533	2015	33458	7481	587/179	92/28	20/6	2038	300	2500
			ZHONG HUA FU XING	中华复兴	412283000	9849875	2019	44403	9356	696/212	95/29	20/6	1689	350	3000
Tianjin Bohai Ferry Shipping Co., Ltd. (天津渤海轮渡航运有限公司)															
			BO HAI MING ZHU	渤海明珠	412303720	8818312	1992	18685	6934	518/158	79/24	20/6	-	-	-
			BO HAI JIN ZHU	渤海金珠	413305960	9486219	2006	19847	6984	528/161	79/24	20/6	-	300	1800
Bohai Hengtong Ferry Co., Ltd. (渤海恒通輪渡有限公司)															
			BO HAI HENG DA	渤海恒达	413254910	9870692	2020	24777	11344	623/190	85/26	20/6	-	300	2700
			BO HAI HENG TONG	渤海恒通	413244930	9870680	2021	24777	11288	623/190	85/26	20/6	-	300	2700
Weihai Haida Passenger Transport Co., Ltd. (威海市海大客运有限公司)															
			SHENG SHENG 1	生生 1	412328670	8741545	2006	10347	2541	394/120	66/20	16/5	1026	123	615
			SHENG SHENG 2	生生 2	413328380	8673293	2013	20472	5493	541/165	79/24	16/5	2160	300	2200
			ZHONG HUA FU QIANG	中华富强	413384000	9899404	2020	37883	8933	610/186	95/29	20/6	2262	300	2600
			SHENG SHENG 3	*生生 3*	*Under construction*		*2023?*	*~37000*	*~8900*	*185*	*29*	*20/6*	*2300*	*300*	*2600*

NOTE: Green blocks indicate years individual ships were observed participating in civil maritime-military events.

[77] 2022 activity as outlined in this report. 2020-21 activity from Dahm, "Chinese Ferry Tales." Ship data aggregated from databases including MarineTraffic.com and VesselFinder.com as well as other industry sources such as shipping industry media reports, Chinese shipping company websites, and company financial reports.

Table 20. COSCO RO-RO Ships (Bohai Gulf Routes)[78]

2020	2021	2022	Name	Name (Chinese)	MMSI	IMO	Year Built	Gross Tonnage	DWT	Length (ft/m)	Beam (ft/m)	Draft (ft/m)	Passengers	Vehicles	LIM (m)
COSCO Shipping Ferry Co., Ltd. (中远海运客运有限公司)															
			BANG CHUI DAO	棒棰岛	412450000	9110781	1995	15560	3547	443/135	75/23	18/5.5	1200	226	835
			HAI YANG DAO	海洋岛	412468000	9110793	1995	15560	3547	443/135	75/23	18/5.5	1200	225	835
			HU LU DAO	葫芦岛	413134000	9305166	2005	16234	3873	450/137	75/23	20/6	1428	235	835
			PU TUO DAO	普陀岛	413127000	9305154	2005	16234	3996	450/137	75/23	20/6	1428	240	835
			WAN RONG HAI	万荣海	412206430	8741569	2008	11585	3252	427/130	66/20	16/5	1108	143	700
			WAN TONG HAI	万通海	412208030	9622497	2010	24205	7646	538/164	82/25	20/6	1618	192	2000
			CHANG SHAN DAO	长山岛	412331000	9520297	2012	24572	7670	551/168	82/25	20/6	1400	350	2000
			LONG XING DAO	龙兴岛	412900000	9517317	2010	24572	7743	551/168	82/25	20/6	1400	350	2000
			YONG XING DAO	永兴岛	412091000	9517329	2011	24572	7662	551/168	82/25	20/6	1400	350	2000
			XIANG LONG DAO	祥龙岛	414556000	9904015	2021	43195	8497	682/208	95/29	23/7	1370	500	2800
			JI LONG DAO	吉龙岛	414510000	9904003	2021	43195	8497	682/208	95/29	23/7	1370	500	2800
			SHUN LONG HAI	顺龙海	414611000	9936020	2022	23249	10839	633/193	85/26	20/6	-	350	3000
			SHUN LONG HAI-Class	-	*Under construction*		*2023?*	*23249*	*10839*	*633/193*	*85/26*	*20/6*	*-*	*350*	*3000*
COSCO Shipping (Qingdao) Co., Ltd. (中远海运(青岛)有限公司)															
			XIN XIANG XUE LAN	新香雪兰	414472000	9885714	2020	32729	5972	623/190	102/31	21/6.5	700	300	1900

NOTE: Green blocks indicate years individual ships were observed participating in civil maritime-military events.

[78] Ibid.

RO-RO Ships—Qiongzhou Strait Ferry Routes and South China Sea Cruise Routes
Forty-eight ROPAX ferries provide regular service across the Qiongzhou Strait between mainland China and Hainan Island. These relatively small ROPAX ships carry up to sixty vehicles on a single vehicle deck. Due to Hainan's tropical heat, the ferries have large openings in the sides of the hull and in the vehicle bay overheads for ventilation, a design that makes them dangerous to operate in heavy seas. Prior to COVID epidemic shutdowns, three ROPAX cruise ships offered South China Sea "eco-tourism" cruises from Sanya to the Paracel (Xisha) Islands. These three ocean-going cruise ships are similar in design to the Bohai Gulf RO-RO ferries (see Figure 33).

COSCO Shipping / Qiongzhou Strait Ferry Transportation – In 2021, 47 RO-RO ferries that operate across the Qiongzhou Strait were consolidated under the ownership of the COSCO-controlled Qiongzhou Strait (Hainan) Ferry Transportation Co., Ltd. (琼州海峡（海南）轮渡运输有限公司).[79] Qiongzhou Strait Ferry Transportation is a joint venture between provincial government-owned Guangdong Xuwen Strait Shipping Co., Ltd. (广东徐闻海峡航运有限公司), which contributed 29 ferries to the joint company, and COSCO subsidiary Hainan Strait Shipping Co., Ltd. (海南海峡航运股份有限公司), which contributed 18 ferries. COSCO's Hainan Strait Shipping apparently has effective control of the joint venture with 51 percent of the voting rights.[80] Following the 2021 consolidation, in March 2022, the joint company formed its own subsidiary, Qiongzhou Strait (Guangdong) Ferry Transportation Co., Ltd. (琼州海峡（广东）轮渡运输有限公司), which now owns all 29 ships originally contributed by Xuwen Strait Shipping.[81] Qiongzhou Strait ferries appear in Table 21.

COSCO Shipping – COSCO subsidiaries operate three ROPAX cruise ships likely chartered to support military activity in 2021 and 2022 after being rendered inactive by COVID-19 restrictions. Hainan Strait Shipping Co., Ltd. (海南海峡航运股份有限公司) owns and operates the CHANG LE GONG ZHU and QI ZI WAN. COSCO subsidiary Sansha Nanhai Dream Cruises Co., Ltd. (三沙南海梦之旅邮轮有限公司) owns and operates the NAN HAI ZHI MENG (Nanhai Dream).[82] Cruise ships appear in Table 22.

[79] There is apparently a single privately owned RO-RO ferry that now operates across the Qiongzhou Strait, the YONGZHENG/YONG JI (永正号) (MMSI 413522080). The consolidated Qiongzhou Strait Ferry company is reportedly trying to run the owners of the YONG JI out of business. See, Wu Yingjiao, 琼州海峡现"不平等条约" ["The Qiongzhou Strait Now an 'Unfair Pact'"], 华夏资讯通 [*China Infocom*], July 12, 2022, https://xueqiu.com/1140252644/226137818.

[80] CITIC Securities, Co., Ltd., 海南海峡航运股份有限公司, 出资组建合资公司重大资产重组报告书 [*Hainan Strait Shipping Co., Ltd., Report on the Investment and Major Asset Restructuring of a Joint Venture Company*], November 2021, pp. 11-12, https://pdf.dfcfw.com/pdf/H2_AN202111091528062976_1.pdf.

[81] 海南海峡航运股份有限公司 [Hainan Strait Shipping Co., Ltd.], 关于向琼州海峡（广东）轮渡运输有限公司增资的公告 ["Announcement of a Capital Increase in Qiongzhou Strait (Guangdong) Ferry Transportation Co., Ltd."], May 28, 2022, http://static.cninfo.com.cn/finalpage/2022-05-28/1213530208.PDF.

[82] *2022 Semi-Annual Report*, p. 145.

1. SHUANG TAI 11

2. SHUANG TAI 29

3. SHUANG TAI 37

4. ZI JING SHI YI HAO

5. WU ZHI SHAN

6. HAI TANG WAN

7. LI MU LING

8. QI ZI WAN

9. NAN HAI ZHI MENG

Figure 33. RO-RO Ships on Qiongzhou Strait Ferry Routes and South China Sea Cruise Routes[83]

[83] Images: 1, 4, 5, 8 – Taizhou Kouan Shipbuilding (http://www.cnkasc.com/sitecn/pro.aspx?cid=1657); 2-3 – "客滚船" [RO-RO Passenger Ships] posted to https://www.sgss8.com/tpdq/21658323 (blog); 6 – "Qiongzhou Strait Ferry MS HaiTangWan" (https://www.youtube.com/watch?v=2rEgrlPJV_0); 7 – 凤凰网海南 [Phoenix Net Hainan] (http://hainan.ifeng.com/a/20191226/8008603_0.shtml); 9 – Nanhai Cruises (https://www.nanhaicruises.com/).

Table 21. Qiongzhou Strait Ferry Transportation RO-RO Ships (Qiongzhou Strait Ferry Routes)[84]

2022 Activi	Name	Name (Chinese)	MMSI	IMO	Year Built	Gross Tonnage	DWT	Length (ft/m)	Beam (ft/m)	Draft (ft/m)	Passengers	Vehicles	LIM (m)
Qiongzhou Strait (Hainan) Ferry Transportation Co., Ltd. (琼州海峡（海南）轮渡运输有限公司)													
	XIN HAI 12 HAO	信海 12 号	412522670		2004	6516		322/98	66/20	21/6.5	790	40	
	XIN HAI 16 HAO	信海 16 号	413520260		2007	6555		348/106	66/20	20/6	963	41	
	XIN HAI 19 HAO	信海 19 号	413522110		2011	8275		394/120	66/20	21/6.5	972	41	
	BAO DAO 12 HAO	宝岛 12 号	413521120		2010	6815		348/106	66/20	20/6	986	41	
	BAO DAO 16 HAO	宝岛 16 号	413522220		2012	8275		390/119	66/20	21/6.5	972	41	
	WU ZHI SHAN	五指山	413523180	9734458	2013	10940	2073	407/124	66/20	21/6.5	999	46	
	HAI TANG WAN	海棠湾	413523980		2014	10124	2773	420/128	69/21	21/6.5	999	46	
	BAI SHI LING	白石岭	413523210	8671087	2013	10940	2529	407/124	69/21	21/6.5	999	46	
	JIAN FENG LING	尖峰岭	413523230		2014	10940	2403	404/123	66/20	21/6.5	999	46	
	YING GE LING	鹦哥岭	413523240	9734460	2014	10940	2148	420/128	66/20	21/6.5	999	46	
	LI MU LING	黎母岭	413523190	9734472	2014	10940	2123	407/124	66/20	21/6.5	999	46	
	TONG GU LING	铜鼓岭	413523220		2014	10940	2393	407/124	66/20	21/6.5	999	46	
	FENG HUANG LING	凤凰岭	413523990		2014	10982	2641	417/127	69/21	21/6.5	999	46	
	LIU LIAN LING	六连岭	413524010		2014	10982	2555	417/127	69/21	21/6.5	999	46	
	HAI XIA YI HAO	海峡一号	413522050		2012	5960		308/94	59/18	20/6	596	30	
	HAI KOU LIU HAO	海口六号	413522480		2012	7959		387/118	66/20	21/6.5	966	50	
	HAI KOU JIU HAO	海口九号	413523430	8531677	2015	9208	3203	423/129	69/21	21/6.5	986	50	
	HAI KOU 16 HAO	海口 16 号	413525630		2016	10387	3314	417/127	69/21	21/6.5	986	60	
Qiongzhou Strait (Guangdong) Ferry Transportation Co., Ltd. (琼州海峡（广东）轮渡运输有限公司)													
	SHUANG TAI 11	双泰 11	413233360		2009	5297		308/94	62/19	18/5.4	650	36	
	SHUANG TAI 12	双泰 12	413233560		2009	5297		308/94	62/19	18/5.4	650	36	
	SHUANG TAI 16	双泰 16	413231030		2012	8410	2000	367/112	69/21	20/6	680	40	
	SHUANG TAI 18	双泰 18	413233570		2011	8965	1900	361/110	66/20	20/6	960	42	

[84] 2022 activity as outlined in this report. Ship data aggregated from databases including MarineTraffic.com and VesselFinder.com as well as other industry sources such as shipping industry media reports, Chinese shipping company websites, and company financial reports.

Table 21. Qiongzhou Strait Ferry Transportation RO-RO Ships (Qiongzhou Strait Ferry Routes) (continued)

2022 Activity	Name	Name (Chinese)	MMSI	IMO	Year Built	Gross Tonnage	DWT	Length (ft/m)	Beam (ft/m)	Draft (ft/m)	Passengers	Vehicles	LIM (m)
Qiongzhou Strait (Guangdong) Ferry Transportation Co., Ltd. (琼州海峡（广东）轮渡运输有限公司) (continued)													
	SHUANG TAI 19	双泰 19	413233580		2011	8965	1900	361/110	66/20	20/6	960	42	
	SHUANG TAI 26	双泰 26	413233590		2015	10360	2623	417/127	69/21	21/6.5	960	50	
	SHUANG TAI 27	双泰 27	413233620		2015	10360	2651	417/127	69/21	21/6.5	960	50	
	SHUANG TAI 28	双泰 28	413233240	9798208	2016	11772	3165	420/128	69/21	21/6.5	999	50	
	SHUANG TAI 29	双泰 29	413233650		2016	11772	3160	420/128	69/21	21/6.5	999	50	
	SHUANG TAI 36	双泰 36	413233630		2019	12787		417/127	69/21	21/6.5	999	50	
	SHUANG TAI 37	双泰 37	413233640		2019	12787		417/127	69/21	21/6.5	999	50	
	YANG FAN HAI AN	扬帆海安	413234640		2015	9045	2863	404/123	66/20	21/6.5	988	48	
	HAI ZHUANG 2 HAO	海装 2 号	413234430		2010	5371		312/95	62/19	18/5.4	680	40	
	HAI ZHUANG 6 HAO	海装 6 号	413234420		2011	7899		358/109	66/20	20/6	780	46	
	HAI ZHUANG 8 HAO	海装 8 号	413234410		2012	7899		358/109	66/20	20/6	780	46	
	TENG SHENG BAO CHANG	腾胜宝昌	413234660		2012	7353		348/106	66/20	20/6	963	46	
	HAI ZHUANG 18 HAO	海装 18 号	413234390		2017	11840	2479	420/128	69/21	21/6.5	998	50	
	NAN FANG 6 HAO	南方 6 号	413234720		2012	7899		358/109	66/20	20/6	780	46	
	SHUANGTAI BAOCHANG	双泰宝昌	413234380		2008	6553		348/106	66/20	20/6	939	46	
	JIN ZI JING	金紫荆	413232890	9320788	2004	5680	4182	305/93	62/19	20/6	650	35	
	YIN ZI JING	银紫荆	413233380		2010	7143		348/106	66/20	20/6	900	45	
	ZI JING JIU HAO	紫荆九号	413234440		2012	7152		348/106	66/20	20/6	680	40	
	HAI XIA ER HAO	海峡二号	413232860		2012	5960		308/94	59/18	20/6	600	35	
	ZI JING SHI YI HAO	紫荆十一号	413233370	9663647	2012	8869	2122	397/121	69/21	21/6.5	959	45	
	ZI JING SHI ER HAO	紫荆十二号	413232490		2013	9224	~3000	397/121	69/21	21/6.5	960	45	
	ZI JING SHI LIU HAO	紫荆十六号	413233350		2016	10669	3150	420/128	69/21	21/6.5	874	45	
	ZI JING SHI WU HAO	紫荆十五号	413232480		2016	11388	3245	417/127	69/21	21/6.5	968	45	
	ZI JING ERSHI ER HAO	紫荆二十二号	413232470		2018	12005	3162	420/128	69/21	21/6.5	999	60	
	ZIJING ERSHI SAN HAO	紫荆二十三号	413231340		2018	12005	3147	420/128	69/21	21/6.5	999	60	

NOTE: Green blocks indicate years individual ships were observed participating in civil maritime-military events.

Table 22. COSCO South China Sea RO-RO Passenger Cruise Ships[85]

2022 Activi	Name	Name (Chinese)	MMSI	IMO	Year Built	Gross Tonnage	DWT	Length (ft/m)	Beam (ft/m)	Draft (ft/m)	Passengers	Vehicles	LIM (m)
Hainan Strait Shipping Co., Ltd. (海南海峡航运股份有限公司)													
	CHANG LE GONG ZHU	长乐公主	413526230	8530192	2017	12336	2191	427/130	69/21	16/5			
	QI ZI WAN	棋子湾	413895000	8670148	2009	11585	3199	427/130	69/21	16/5			
Sansha Nanhai Dream Cruises Co., Ltd. (三沙南海梦之旅邮轮有限公司)													
	NAN HAI ZHI MENG	南海之梦	412237000	9520285	2011	24629	5995	558/170	82/25	20/6	721	350	

NOTE: Green blocks indicate years individual ships were observed participating in civil maritime-military events.

[85] Ibid.

Vehicle Carriers

Vehicle carriers, sometimes called pure car carriers (PCC) or pure car/truck carriers (PCTC) are large, ocean-going cargo ships with multiple decks of interior space maximized for transporting fleets of vehicles (see Figure 34). While seemingly optimal for moving large formations of military vehicles, they likely do not have facilities to accommodate large numbers of personnel (seating, kitchens, restrooms, etc.) for long at-sea periods. Some vehicle carriers have drafts greater than 30 feet (9 meters), limiting the ports that may be used for embarkation and debarkation. In 2022, large vehicle carriers were also in high demand for vehicle imports/exports and moving fleets of new vehicles to market within China, probably limiting their availability for military exercises.

Jiangsu Dafeng Port Holding Group – Jiangsu Dafeng Port Holding Group (江苏大丰海港控股集团) and Jiangsu Yueda Logistics Co., Ltd. (江苏悦达物流有限公司) own two large, ocean-going RO-RO vehicle carriers as part of a joint venture. One of these ships—DA FENG GANG LI MING HAO—has been noted supporting Chinese military activities since 2021.[86] Jiangsu Dafeng Port Holdings is a Chinese SOE primarily focused on port management and logistics. Yueda is a logistics company that provides auto shipping logistics for Dongfeng Yueda Kia automobile manufacturing company. The two Dafeng/Yueda vehicle carriers are managed by Weihai Sheng An Shipping Co., Ltd. (威海市升安海运有限责任公司).[87] Weihai Sheng An manages four other large vehicle carriers (SHI HAI, SHI JIANG, SHI YANG, and SHI YUAN) for Kingfour Marine Co., Ltd. (中甫(上海)航运有限公司), a subsidiary of CDC International Logistics.[88] There are no indications that the Kingfour vehicle carriers have supported Chinese military exercises and are not listed in Table 23.

China Merchants Group – China Merchants Guangzhou RO-RO Shipping Co., Ltd. (广州招商滚装运输有限公司) (CMRORO) is a joint venture created in 2019 by China Merchants Energy Shipping (70 percent share) and Guangzhou Automobile Group Business Co., Ltd. (30 percent).[89] CMRORO operates 10 ocean-going vehicle carriers and several river vehicle carriers. Only one of these vehicle carriers, CHANG DA LONG, has been noted supporting the PLA since at least 2018.

COSCO Shipping – COSCO Shipping Specialized Carriers Co., Ltd. (中远海运特种运输股份有限公司) operates five large, ocean-going vehicles carriers.[90] None of these ships have been noted supporting Chinese military activity. They are, however, included in Table 23 because of COSCO's established relationship with the PLA. COSCO SHENGSHI and COSCO SHENGSHI are Panama-flagged vessels typically employed on long-haul international routes.

SAIC AnJi Logistics – SAIC Motors, China's largest automaker, operates fourteen ocean-going vehicle carriers through SAIC AnJi Logistics Co., Ltd. (上汽安吉物流股份有限公司) and its

[86] 大丰港“杀”入沿海滚装船运输 ("Dafeng Port 'Reduced' to Coastal RO-RO Transport"), 航运交易公报 (*Shipping Transaction Bulletin*), February 16, 2017, https://www.cnss.com.cn/html/gkdt/20170216/258226.html.

[87] 威海市升安海运有限责任公司简介 [Introduction of Weihai Sheng'an Shipping Co., Ltd.], Weihai Sheng'an Shipping Co., Ltd., accessed October 10, 2022, http://www.sdseafarer.com/col.jsp?id=108.

[88] 滚装航运业务 ["RO-RO Shipping Business"], CDC International Logistics Co., Ltd, accessed October 10, 2022, http://www.cdcgroup.com.cn/group/showimg.php?lang=cn&id=41.

[89] "RO-RO Shipping," China Merchants Energy Shipping Co. Ltd., accessed October 10, 2022, https://www.cmenergyshipping.com/page.php?p=spec.

[90] "Fleet," COSCO Shipping Specialized Carriers Co., Ltd., accessed October 10, 2022, http://spe.coscoshipping.com/main/fleet.

shipping subsidiaries.[91] None of these Chinese-flagged RO-RO vehicle carriers have been noted supporting Chinese military activity. Therefore, they are not included in Table 23.

1. DA FENG GANG LI MING HAO

2. CHANG DA LONG

3. CHANG TAI HONG

4. MAO HONG

5. CHANG RONG KOU

6. COSCO SHENGSHI

Figure 34. Vehicle Carriers[92]

[91] 航运物流 [“Shipping Logistics”], SAIC AnJi Logistics, accessed October 10, 2022, https://anji-logistics.e-ciie.com/cn/2018/shipping_1025/5.html.

[92] Images: 1 – Weihai Sheng An Shipping (http://www.sdseafarer.com/pd.jsp?id=16#_pp=2_338); 2 – China Military Television Network (https://www.js7tv.cn/video/202006_219448.html); 3 – China Merchants Energy Shipping (https://www.cmenergyshipping.com/page.php?p=spec); 4 – China Merchants Industry (https://www.xindemarinenews.com/topic/chuanbojianzhao/2022/0418/37834.html); 5-6 – COSCO Shipping Specialized Carriers (http://spe.coscoshipping.com/main/fleet?name=滚装船&index=5).

Table 23. Chinese Military-Affiliated RO-RO Vehicle Carriers[93]

2020	2021	2022	Name	Name (Chinese)	MMSI	IMO	Year Built	Gross Tonnage	DWT	Length (ft/m)	Beam (ft/m)	Draft (ft/m)	Passengers	Vehicles	LIM (m) [94]
Weihai Sheng An Shipping Co., Ltd. (威海市升安海运有限责任公司)															
	■	■	DA FENG GANG LI MING HAO	大丰港黎明号	413239310	9188790	1999	33863	10834	538/164	92/28	30/9	-	3578	~10000
			DA FENG GANG HE SHUN HAO	大丰港和顺号	414284000	9188805	1999	33831	10818	538/164	92/28	30/9	-	3578	~10000
Guangzhou China Merchants RO-RO Transportation Co., Ltd. (广州招商滚装运输有限公司)															
			CHANG XIANG LONG	长祥隆	413233230	9442598	2009	19370	5594	463/141	79/24	20/6	-	2200	~6600
			CHANG XING LONG	长兴隆	413240580	9556777	2009	19370	5508	463/141	79/24	20/6	-	2200	~6600
			CHANG FA LONG	长发隆	413468970	9442627	2011	19222	6561	463/141	79/24	20/6	-	2200	~6600
■		■	CHANG DA LONG	长达隆	413473010	9471197	2012	19684	5836	463/141	79/24	20/6	-	2200	~6600
			CHANG JI LONG	长吉隆	413463060	9442586	2009	19370	5568	463/141	79/24	20/6	-	2200	~6600
			CHANG WANG LONG	长旺隆	413301850	9556789	2010	19207	5512	463/141	79/24	20/6	-	2200	~6600
			CHANG SHENG HONG	长盛鸿	414317000	9177040	2000	37237	12743	551/168	102/31	30/9	-	4632	~14000
			CHANG TAI HONG	长泰鸿	414249000	9382102	2009	40619	12282	554/169	102/31	26/8	-	4870	~14000
			MAO HONG	茂鸿	414526000	9903217	2021	35425	11773	554/169	92/28	26/8	-	4500	~13500
			TANG HONG	塘鸿	414496000	9903205	2021	35425	11783	554/169	92/28	26/8	-	4500	~13500
COSCO Shipping Specialized Carriers Co., Ltd. (中远海运特种运输股份有限公司)															
			CHANG AN KOU	常安口	414260000	9177026	1999	37237	12780	581/177	102/31	30/9	-	4632	~14000
			CHANG RONG KOU	常荣口	414276000	9177038	2000	37237	12780	581/177	102/31	30/9	-	4632	~14000
			YU HENG XIANG FENG	玉衡先锋	412163000	9166895	1998	53240	13418	591/180	105/32	30/9	-	4305	~14000
			COSCO SHENGSHI	中远盛世	372727000	9454711	2011	51671	14500	571/174	105/32	30/9	-	5276	~16000
			COSCO TENG FEI	中远腾飞	355518000	9454723	2011	51699	14500	571/174	105/32	30/9	-	5276	~16000

NOTE: Green blocks indicate years individual ships were observed participating in civil maritime-military events.

[93] 2022 activity as outlined in this report. 2020-21 activity from Dahm, "Chinese Ferry Tales." Ship data aggregated from databases including MarineTraffic.com and VesselFinder.com as well as other industry sources such as shipping industry media reports, Chinese shipping company websites, and company financial reports.

[94] LIM (Lanes in Meters) estimated based on reported vehicle capacity. 1 CEU (car equivalent unit) is typically 4 m x 1.5 m. Estimate assumes a 2 m wide lane.

Cargo Ships, Barges, and Tugs
Several general cargo ships and barges supported Chinese military activity in 2022. Tugs and other utility craft employed during military exercises were probably hired from harbors near exercise areas. Examples of tugs used to assist with floating causeway operations in Dacheng Bay include GU GANG TUO 3 and GU GANG TUO 4 from the nearby port of Gulei. Cargo ships and barges that provided significant civil-military support are shown in Figure 35 and listed in Table 24.

China Merchants Group – In 2017, Sinotrans Limited and the Changjiang Shipping Corporation (CSC) (Sinotrans CSC Group) were acquired by China Merchants Group.[95] CSC subsidiary Shanghai Changjiang Shipping Corporation (SCSC) (上海长江轮船有限公司) owns and operates two 8000 DWT-class general cargo ships, CHANG XIONG and CHANG ZAN, that provided year-round support to the PLA in 2022. Each feature two 50-ton deck cranes.[96] SCSC's 5000 DWT-class general cargo ship TIAN ZHU SHAN supported PLA exercises in 2020 and 2021 but not in 2022. Another Sinotrans CSC Group subsidiary, China Yangtze River Shipping Co., Ltd. (中国扬子江轮船股份有限公司), owns the 5000 DWT-class general cargo ship SHENG TAI, which has supported PLA activity since at least 2020. SHENG TAI is currently managed by SCSC.[97]

Old Captain Shipping Corporation – Qingdao Old Captain Shipping Co., Ltd. (OSCO) (青岛老船长航运有限公司) is a privately-held shipping company that likely owns and operates the FU YUN 828. FU YUN 828 appears to be a 5000 DWT-class general cargo ship very similar to the SHENG TAI. 2022 is the first year an OSCO ship has been noted transporting military vehicles for a PLA exercise. According to the company's web site, OSCO was among the first private Chinese companies to participate in the PLA's South China Sea island-building project in 2012.[98]

China Communications Construction Corporation – China Communications Construction Corporation (CCCC) (中国交通建设股份有限公司) is a large Chinese SOE. The CCCC Third Engineering Co., Ltd. (中交三航局第三工程有限公司) operates the SAN HANG GONG 8, a semi-submersible barge that is normally used in port construction projects.[99] SAN HANG GONG 8 is used as the docking/transfer platform for the PLA's floating causeway system.

XINHAISHENG 8 Owner – Ownership and management could not be determined for the XINHAISHENG 8, a 106 x 22-meter self-propelled deck barge. A Chinese-manufactured 106-meter deck barge similar to XINHAISHENG 8 is shown in Figure 35.

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[95] Lee Hong Liang, "China Merchants, Sinotrans & CSC Complete Strategic Reorganisation," *Seatrade Maritime News*, April 11, 2017, https://www.seatrade-maritime.com/asia/china-merchants-sinotrans-csc-complete-strategic-reorganisation.

[96] 宜昌达门建造 8000 吨多用途船首制船下水 ["Yichang Damen (Shipping Co.) Builds and Launches its First 8000-ton Multi-Purpose Ship"], *International Ship Network*, October 1, 2021, http://www.eworldship.com/html/2021/NewShipUnderConstrunction_1001/175339.html.

[97] SHENG TAI ownership and management information from VesselFinder.com, accessed October 13, 2022, https://www.vesselfinder.com/pro/map#vessel-details?imo=9169304&mmsi=412081630.

[98] 集团简介[Group Profile], Old Captain Enterprise Group, accessed October 14, 2022, http://www.cnocsc.com/about.aspx?id=277.

[99] 古雷北 1#、2#泊位工程完成全部沉箱安装 ["Gulei North #1 and #2 Berths Completed All Caisson Installations"], 人民網-福建頻道 [*People's Daily Online – Fujian Channel*], March 19, 2020, http://fj.people.com.cn/BIG5/n2/2020/0319/c181466-33889385.html.

1. CHANG XIONG

2. TIAN ZHU SHAN

3. SHENG TAI

4. SAN HANG GONG 8

5. 106-meter Self-Propelled Deck Barge similar to XINHAISHENG 8

Figure *35*. Cargo Ships and Barges[100]

[100] Images: 1-3 – Toanthang Shipping (https://www.toanthangship.com/en/mv-chang-xiong.html, https://www.toanthangship.com/en/mv-tian-zhu-shan-1649061283.html, https://www.toanthangship.com/en/mv-sheng-tai.html); 4 – *People's Daily Fujian* (http://fj.people.com.cn/BIG5/n2/2020/0319/c181466-33889385-2.html); 5 – Example of 106m self-propelled deck barge manufactured in China (https://www.wotol.com/product/106-m-5154-dwt-ocean-going-self-propelled-deck-barge/2208338).

Table 24. Military-Affiliated Cargo Ships and Barges[101]

2020	2021	2022	Name	Name (Chinese)	MMSI	IMO	Year Built	Gross Tonnage	DWT	Length (ft/m)	Beam (ft/m)	Draft (ft/m)
Sinotrans CSC Group												
Shanghai Changjiang Shipping Co., Ltd. (上海长江轮船有限公司) (SCSC)												
		■	CHANG ZAN	长赞	413307520	9916111	2022	7732	9085	400/122	66/20	23/7
		■	CHANG XIONG	长(長)富	413380840	9553361	2010	6550	8394	387/118	59/18	23/7
■	■		TIAN ZHU SHAN	天柱山	412076010	8888927	1995	4061	4944	420/128	66/20	23/7
China Yangtze River Shipping Co., Ltd. (中国扬子江轮船股份有限公司) (Managed by SCSC)												
■	■	■	SHENG TAI	盛泰	412081630	9169304	1997	4048	5210	325/99	56/17	20/6
Qingdao Old Captain Shipping Co., Ltd. (青岛老船长航运有限公司)												
		■	FU YUN 828	福运 828	412330280				~5000	325/99	56/17	~20/6
CCCC Third Engineering Co., Ltd. (中交三航局第三工程有限公司)												
■	■	■	SAN HANG GONG 8	三航工 8	413378280			-		213/65	118/36	18/5.5
Unknown Owner												
		■	XINHAISHENG 8	新海升 8	413288610			-	~5000	348/106	72/22	~14/4

NOTE: Green blocks indicate years individual ships were observed participating in civil maritime-military events.

[101] 2022 activity as outlined in this report. 2020-21 activity from Dahm, "Chinese Ferry Tales." Ship data aggregated from databases including MarineTraffic.com and VesselFinder.com as well as other industry sources such as shipping industry media reports, Chinese shipping company websites, and company financial reports.

Appendix B. Chinese Ports Supporting Civil-Military Activity

Observed activity in 2021-2022 included 37 ports and terminals used by civilian RO-RO and cargo ships to support military activity. These comprise 31 civilian facilities as well as six PLAN bases. Ports and terminals used in civil maritime-military events, less the three main South China Sea Spratly Island bases (Fiery Cross, Subi, and Mischief Reefs), are shown in Figure 37. Table 25 lists ports and terminals used by the PLA in civil maritime-military events between October 2021-September 2022. No additional ports and terminals beyond those listed in Table 25 were identified in prior analysis of 2020-2021 civil maritime-military activity.[102] Table 26 lists civilian ferry terminals that normally facilitate services across the Bohai Gulf and across the Qiongzhou Strait between the Chinese mainland and Hainan Island. Military use of ferry terminals is difficult to discern from normal activity.

Many of the ports and terminals listed in Tables 25 and 26 are identified as having one or several "RO-RO ramps." These are either a mechanical ramp that connects to a quay wall or pier, or a concrete ramp that extends down into the water. These ramps help RO-RO ship ramps further compensate for the changes in the height of the quay wall or pier above the water due to tides. In areas with significant tidal variations and no RO-RO ramp, RO-RO ship docking must be timed with high tides.

Many of the ports and terminals listed in Tables 25 and 26 are also identified as having a rail transfer point ("Rail X-fer Point"). These are railroad spurs located in the port or terminal area that may allow the PLA to move military vehicles in and out of ports via rail. Several civilian ferry terminals also service train ferries, onto which rail cars carrying vehicles and cargo can be loaded and unloaded. This rail capability is especially useful for moving tanks and other heavy equipment that would otherwise require an excessive amount of fuel to move long distances under their own power. In lieu of rail, tanks must normally be moved by heavy equipment transport (HET). Figure 36 shows tanks and other armored vehicles loading onto flat-bed rail cars after unloading from the RO-RO ferry ZHONG HUA FU XING in Qinhuangdao in October 2021.[103]

Figure 36. Rail Transfer, Qinhuangdao Port, October 2021 (CCTV)

[102] Dahm, "Chinese Ferry Tales."

[103] "PLA Uses Zhong Hua Fu Xing Cruise-Type RO-RO Passenger Ship for Military Transportation," 央视军事 [*CCTV Military*], October 16, 2022, https://www.youtube.com/watch?v=gxJj9G55dQA.

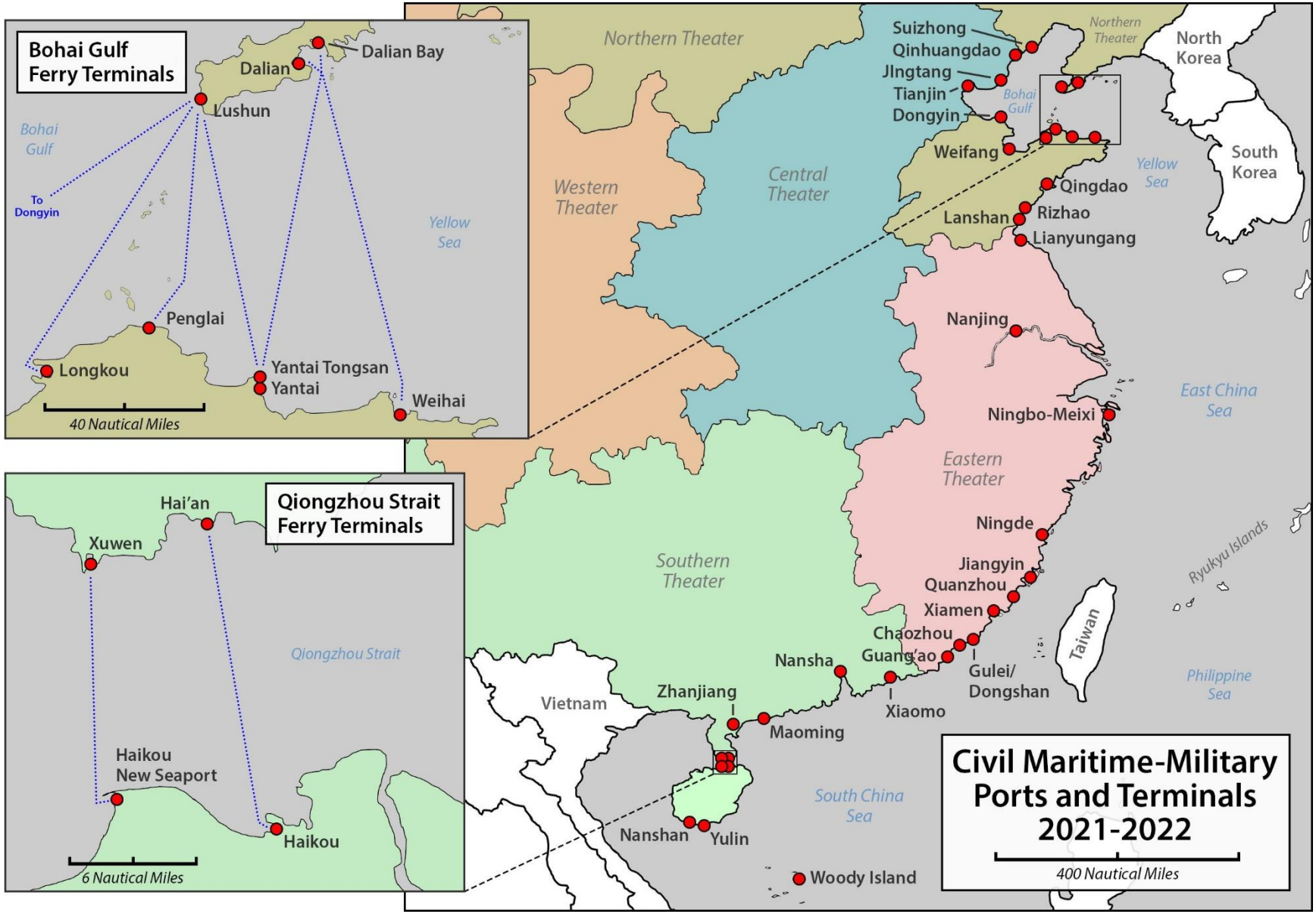

Figure 37. Civil-Military Ports and Terminals, 2021-2022

Table 25. Ports and Terminals Used in Civil Maritime-Military Events, October 2021-September 2022

Name	Name (Chinese)	Alternate Name or *Co-located Facilities (in italics)*	Coordinates (decimal degrees)	RO-RO Ramp	Rail X-fer Point
Northern Theater					
Suizhong Port	绥中港		40.0799, 120.120		
Weifang Port	潍坊港		37.231, 119.163	■	
Qingdao Port	青岛港		36.100, 120.326	■	■
Rizhao Port	日照港		35.376, 119.535	■	■
Lanshan Port	岚山港		35.098, 119.371		■
Central Theater					
Qinhuangdao Port	秦皇岛港		39.911, 119.583		■
Jingtang Port	京唐港		39.198, 118.981		■
Tianjin Port	天津港		38.987, 117.735		■
Tianjin Int'l Cruise Ship Terminal	天津国际邮轮母港		38.975, 117.820	■	
Eastern Theater					
Lianyungang Port	连云港港	*Lianyungang Int'l Passenger Terminal (连云港港国际客运站)*	34.751, 119.374	■	■
Nanjing Port	南京港	Nanjing Jiangsheng Automobile Terminal (南京港江盛汽车码头)	32.220, 119.069	■	
Ningbo-Meixi RO-RO Terminal	宁波梅西滚装码头	*Ningbo Meishan Island International Container Terminal (宁波梅山岛国际集装箱码头)*	29.765, 121.990		
Ningde Port	宁德港		26.746, 119.634	■	
Jiangyin Port	江阴港	Fujian Jiangyin Int'l Container Terminal (福建江阴国际集装箱码头)	25.417, 119.286		■
Quanzhou Port	泉州港	Shishi Shihu Port Area (石狮石湖港区)	24.818, 118.721		
Xiamen Haixiang Wharf	海翔码头	*CCCC Third Engineering Bureau (Xiamen) (中交三航局厦门分公司)*	24.532, 118.229		
Xiamen Cruise Terminal	厦门邮轮码头		24.495, 118.071	■	
Xiamen Xiangyu Wharf	厦门象屿码头	Xiamen Xiangyu Free Trade Area	24.516, 118.080		■

Table 25. Ports and Terminals Used in Civil Maritime-Military Events, October 2021-September 2022 (continued)

Name	Name (Chinese)	Alternate Name or *Co-located Facilities (in italics)*	Coordinates (decimal degrees)	RO-RO Ramp	Rail X-fer Point
Eastern Theater (continued)					
Gulei Wharf	古雷码头		23.767, 117.582		
Dongshan Port	东山港		23.760, 117.498		
Chaozhou Port	潮州港		23.557, 117.100		
Guang'ao Port	广澳港	Shantou China Merchants Port (汕头市招商局港)	23.226, 116.778	■	
Southern Theater					
Xiaomo Port	小港港	Xiaomo International Logistics Port (小漠国际物流港)	22.746, 115.034		
Nansha Port / Shazai Island	南沙港 / 沙仔岛	Guangzhou Port Nansha Car Terminal (广州港南沙汽车码头)	22.866, 113.545		
Nansha Container Terminal	南沙集装箱码头	Guangzhou Port Nansha Container Terminal Phase 1 (广州港南沙集装箱一期码头)	22.659, 113.677		
Maoming Port	茂名港	Maoming Guanggang Terminal (茂名广港码头)	21.422, 111.288		
Zhanjiang Naval Base	湛江海军基地	Maxie Naval Base (麻斜海军基地)	21.230, 110.441	■	
Zhanjiang Ferry Port	湛江渡口港		21.240, 110.420	■	
Nanshan Port	南山港		18.319, 109.146	■	
Yulin Naval Base	榆林海军基地		18.221, 109.537		
Woody Island (Yongxing Dao)	永兴岛		16.828, 112.336	■	
Subi Reef (Zhubi Jiao)	渚碧礁		10.938, 114.085	■	
Mischief Reef (Meiji Jiao)	美济礁		9.926, 115.529	■	
Fiery Cross Reef (Yongshu Jiao)	永暑礁		9.553, 112.894	■	

NOTE: Green blocks indicate presence of infrastructure. PLAN bases highlighted in red.

Table 26. China RO-RO Ferry Terminals

Name	Name (Chinese)	Alternate Name or Co-located Facilities (in italics)	Coordinates (decimal degrees)	RO-RO Ramp	Rail X-fer Point
Bohai Gulf Ferry Terminals					
Dalian Bay Port	大连湾港		39.026, 121.738		
Dalian Port	大连港		38.934, 121.658		
Lushun New Port	旅顺新港	Dalian Yanda Railway Ferry Port (大连烟大铁路轮渡港)	38.809, 121.133		
Dongyin Port Terminal	东营港码头		38.075, 118.948		
Penglai New Port	蓬莱新港	Penglai Port Passenger Terminal (蓬莱港客运站)	37.814, 120.831		
Longkou Port	龙口港	Longkou Port Passenger Terminal (龙口港客运站)	37.651, 120.319		
Yantai Port	烟台港	Yantai Port Passenger Terminal (烟台港客运站)	37.552, 121.385		
Yantai Salvage Bureau Passenger Terminal	烟台打捞局客运码头		37.598, 121.388		
Yantai Tongsan Port	烟台同三港	Yantai N. Railway Station (Ferry Station) (烟台北站(轮渡站)	37.588, 121.378		
Weihai Port	威海港	Weihai Ro-Ro Ship Terminal (威海滚装船码头)	37.432, 122.183		
Qiongzhou Strait Ferry Terminals					
Xuwen Port	徐闻港	Guangdong-Haizhou Railway N. Port Pier (粤海铁路北港码头)	20.234, 110.137		
Hai'an Port	海安港		20.269, 110.230		
Hai'an New Port	海安新港		20.267, 110.213		
Haikou Port	海口港		20.025, 110.282		
Haikou New Seaport	海口市新海港	Haikou Railway South Port Pier (海口铁路南港码头)	20.058, 110.152		

NOTE: Green blocks indicate presence of infrastructure.

About the Author

J. Michael Dahm is a retired U.S. Navy intelligence officer with 25 years of service. He has focused on Asia-Pacific security matters since 2006 when he served as Chief of Intelligence Plans for China and later established the Commander's China Strategic Focus Group at the U.S. Pacific Command. From 2012-2015, he was an Assistant Naval Attaché at the U.S. Embassy in Beijing, China. Before retiring from the Navy in 2017, he served as the Senior Naval Intelligence Officer for China at the Office of Naval Intelligence.

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Sources and Methods

This report fuses a variety of publicly and commercially available sources to gain detailed insights into often complex military activity and capabilities. Analysis is supported with AIS data from MarineTraffic—Global Ship Tracking Intelligence.[104] Google Earth images are attributed to the commercial satellite provider and published under the Google Earth terms of service.[105] The report features commercial satellite imagery from Planet Labs PBC. Medium-resolution satellite imagery from Planet's PlanetScope constellation (ground sample distance (GSD) ~3.7 meters) and high-resolution satellite imagery from Planet's SkySat constellation (GSD ~0.5 meters) were purchased by the author 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 author through SkyWatch Space Applications Inc.[106] The SkyWatch team's advice and assistance in accessing archived imagery and tasking satellite collection was greatly appreciated. The author is responsible for all annotations of satellite images contained in this report. Planet and Airbus retain copyrights to the underlying PlanetScope, SkySat, Pleiades, and Pleiades Neo 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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