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### China Maritime Report No. 16: Chinese Ferry Tales: The PLA's Use of Civilian Shipping in Support of Over-the-Shore Logistics

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## **Summary**

The People's Liberation Army (PLA) has long provided indications it will use civilian shipping in direct support of a cross-strait invasion of Taiwan. To date, however, there has been little effort to gauge the PLA's actual ability to leverage China's commercial fleet in the most challenging part of any such campaign—operations over-the-shore. Drawing from ship tracking data, satellite imagery, media reporting, and the writings of PLA experts, this report analyzes recent military-civil fusion exercises and training to assess current capabilities. A PLA exercise in summer 2020 indicates significant developments in the use of new technologies by select Chinese-flagged merchant ships for over-the-shore logistics support to amphibious operations. In 2021, the PLA also demonstrated the use of roll-on/roll-off (RO-RO) ferries as auxiliary landing ships in amphibious exercises and tested a new floating causeway that could be used in a large-scale amphibious operation. Notwithstanding these developments, this report concludes that as of 2021, China's merchant fleet is unable to provide the amphibious landing capabilities or the maritime logistics in austere or challenging environments necessary to have a significant impact in an amphibious landing operation on Taiwan.

## **Introduction**

The PLA will probably not be able to conduct a successful cross-strait invasion of Taiwan until and unless it masters what the U.S. military calls joint logistics over-the-shore (JLOTS). While "JLOTS" is not a term Chinese military authors typically use, they have nevertheless considered how the PLA should conduct logistical support immediately after a large-scale amphibious assault and have commented on such capabilities the PLA may require. These capabilities include unloading in rudimentary or damaged port facilities; using temporary piers or wharves to offload vehicles and supplies directly to shore; and unloading cargo ships, including RO-RO ships, at-sea and then lightering materiel to a captured port or beachhead.

PLA authors uniformly assert that civilian ships, working closely with the military, will be an integral component of any major cross-sea logistics operation, including over-the-shore operations. In recent years, the PLA has conducted a number of exercises to bolster military-civil fusion (MCF) in amphibious operations. To what extent have these exercises helped develop the JLOTS capabilities needed for a Taiwan invasion?

This report sheds light on this vital question by carefully examining MCF exercises in 2020 and 2021. In the summer of 2020, the PLA's Joint Logistics Support Force (JLSF) conducted a complex, large-scale maritime logistics exercise in China's Eastern Theater, the military theater that would be responsible for a cross-strait invasion. Taking place in Lianyungang, Jiangsu province, the exercise—called EASTERN TRANSPORTATION-PROJECTION 2020A—featured the JLSF working closely with a large number of substantial civilian RO-RO ferries, cargo ships, tugs, and construction vessels as well as PLA landing craft in an amphibious logistics exercise that became increasingly complex over two months. While the PLA did not repeat this exercise in the summer of 2021, it did conduct unit-level training in the Southern Theater Command and a large exercise in the Eastern Theater Command. These amphibious exercises appeared to move beyond benign logistics or the deployment of second echelon forces in amphibious landing areas. They saw civilian RO-RO ferries working in concert with larger PLA Navy (PLAN) amphibious assault ships, deploying first echelon forces offshore in beach landing operations. In September 2021, the PLA also tested and evaluated a new floating causeway system, an effort to improve on a modular floating pier showcased in 2020.

This report integrates open-source media reports with ships' tracking data from automatic identification system (AIS) terminals and commercial satellite imagery to reconstruct the 2020 and 2021 MCF exercises. Based on an in-depth analysis of the events, the report offers the following

conclusions about the PLA's capabilities to conduct amphibious operations using civilian ships as a core component of a large-scale amphibious operation:

- As of 2021, the PLA and its reserve civilian merchant fleet are 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.
- The PLA's use of civilian shipping in amphibious exercises appears to be limited to select ships demonstrating nascent capabilities, but not the capacities necessary to support a cross-strait invasion. However, capacities could increase rapidly after initial capabilities are formally adopted and exercise participation expands to a larger number of civilian ships.
- 2020-2021 exercise events appeared to be scripted and focused on establishing procedures and coordination among military units and civilian components.
- The 2020 JLSF exercise featured experimentation with a number of novel logistics capabilities that have been slow to develop and have likely not yet matured probably due to a lack of investment. In a possible change in that trend, 2021 activity saw the introduction of the first new amphibious landing technologies in over fifteen years.
- In most cases, civilian shipping support to amphibious exercises was provided during daylight hours; events were timed for when tides and weather conditions were favorable; many evolutions took place in the sheltered waters of an inner harbor.
- In the 2020 JLSF exercise, there was no evidence of simulated combat conditions during the exercise; no defensive actions (e.g. convoying, escorting, evasion or diversion) were observed. In the 2021 amphibious landing exercises, civilian ferries appeared to be deployed and positioned to mitigate potential threats to these vulnerable ships.
- These 2020-2021 exercises likely provide a baseline for the PLA's use of civilian shipping to support large-scale amphibious logistics and provide a roadmap for the types of capabilities and capacities the PLA may need for future operations.

### **JLOTS with Chinese Characteristics**

According to U.S. military doctrine, logistics over-the-shore, or "LOTS," operations involve the loading and offloading of ships in austere areas where fixed port facilities are damaged, unavailable, or inadequate for operational needs. Joint logistics over-the-shore (JLOTS) operations occur when forces from different services—in the case of the U.S. military, the Army, Navy and Marine Corps—join forces in LOTS operations.<sup>1</sup>

While some Chinese military authors have examined U.S. concepts and translated JLOTS as 岸滩联合后勤 (literally, "shore-beach joint logistics"), the U.S. term does not appear to have been widely adopted by Chinese military scholars.<sup>2</sup> Nevertheless, the Chinese military has discussed how to conduct logistics operations where port facilities are not available. Terms more typically associated with these operations include 人工港 (artificial port) and 无码头卸载 ("no-dock," or "dockless"

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<sup>1</sup> Joint Pub 4-0, Joint Logistics, 4 February 2019, Incorporating Change 1, 8 May 2019, H-1—H-2.

<sup>2</sup> 吴刚 [Wu Gang], 岸滩联合后勤军交运输保障研究 ["Study on Military Transportation Support of Joint Logistics Over-the-Shore Operations"], 军事交通学院学报 [*Journal of Military Transportation University*], 16 no. 7 (July 2014), 9-12.



unloading). This terminology is employed most often in the context of an amphibious “landing base” (登陆基地). A landing base is established immediately after a successful amphibious assault by quickly deploying the at-sea component of the “transportation and projection force” (运输投送力量). In a post-amphibious assault scenario, the transportation and projection force facilitates transshipment of second echelon troops and heavy equipment from ships offshore. Use of the landing base is expected to continue until an adequate “fixed transshipment base” (固定转运基地) can be established in a captured enemy port or harbor.<sup>3</sup>

PLA experts have taken lessons from Chinese and foreign military history underscoring the significance of access to amphibious landing bases. The 1949 campaign to seize Kinmen (Jinmen) Island, in which Republic of China (ROC) nationalist forces routed a PLA amphibious raid, stands out as one example in many Chinese writings. The loss occurred in large part because PLA boats that had landed successfully on Kinmen at high tide became stranded at low tide. Unable to return and bring second-echelon reinforcements from the mainland, ROC forces decimated the exposed craft. Two Chinese military authors took a pointed lesson from the Kinmen campaign: “Even if the first echelon combat force can seize the beachhead, if logistic support cannot keep pace, the follow-on echelon will not be able to disembark, which will have a great impact on the entire landing operation and even the overall joint operation in extreme cases.”<sup>4</sup>

The amphibious logistics required for a cross-strait invasion of Taiwan would be significantly larger than that associated with the battle over the small island of Kinmen. Allied over-the-shore logistics during the invasion of Normandy in the Second World War appears to be required reading for PLA logistics students given the number of references to that operation. In a January 2020 article, PLA experts observed that the strategic port of Cherbourg, France, located a few miles from the Allied beachheads on the Normandy coast, had been effectively destroyed and booby-trapped by retreating German forces. It took British and American forces three weeks to restore Cherbourg port operations. The authors asserted that Taiwan forces would also sabotage ports and harbors if the PRC attempted to invade the island. Therefore, like successful Allied efforts to conduct logistics operations through an artificial port built in Normandy, the PLA must also have capabilities to move significant amounts of materiel, equipment, and personnel ashore in the absence of adequate port infrastructure.<sup>5</sup>

Chinese military authors writing on logistics uniformly assert that civilian shipping will be an integral component of any large-scale “cross-sea projection” (跨海投送) operation, especially a cross-strait invasion of Taiwan.<sup>6</sup> The 1982 Falklands War is another favored case study for PLA

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<sup>3</sup> 汪欣, 王广东 [Wang Xin and Wang Guangdong], 运输投送力忧在跨海登岛作战登陆基地建设中的运用研究 “Application of Transportation and Projection Power to the Opening of Landing Bases in Sea-Crossing Landing Operations,” 国防交通工程与技术 [National Defense Transportation Engineering and Technology], 17 no. 5 (September 2019), 14.

<sup>4</sup> 黄谦, 王红旗 [Huang Qian and Wang Hongqi], 两栖重型合成旅登陆作战后勤保障 [“A Probe into the Logistical Support of the Amphibious Heavy Synthetic Brigade”], 国防科技 [National Defense Technology], 40 no. 3 (June 2019), 89.

<sup>5</sup> 罗雷, 王广东, 赵哲明, 韩亮 [Luo Lei, Wang Guangdong, Zhao Zheming, and Han Liang], 诺曼底登陆人工港的建设与启示 [“Construction and Enlightenment of Normandy Landing Artificial Port”], 军事交通学院学报 [Journal of Military Transportation University], 22 no. 1 (January 2020), 15-17.

<sup>6</sup> 跨海投送 (cross-sea projection) is a term that has been used to describe these types of civil-military operations since at least 2015. See, for example, 李开强, 吴俊伟 [Li Kaiqiang and Wu Junwei], 空军跨海远程投送 横跨渤海东南海四大海域 [“Air Force Cross-Sea Long-Distance Projection across the Four Great Seas—Bohai, Yellow, South, and East Seas”], 新华网 [Xinhuanet], June 12, 2015, [http://www.xinhuanet.com/mil/2015-06/12/c\\_127908248.htm](http://www.xinhuanet.com/mil/2015-06/12/c_127908248.htm).

logisticians who are quick to point out that Great Britain's Royal Navy requisitioned not only tankers, RO-RO cargo ships, and container ships, but also passenger ships, tugboats, fishing boats, and other vessels.<sup>7</sup> Chinese military authors appear to categorize transportation and projection capabilities as either military or civilian. In terms of maritime projection forces, one Chinese military author observes that the PLA uses five types of ships to support amphibious logistics—amphibious dock ships, tank landing ships and landing craft, RO-RO ships, ordinary cargo ships, and fishing boats.<sup>8</sup>

Chinese military authors have identified several different capabilities they believe the PLA should have to support amphibious landing bases. These capabilities include temporary facilities for unloading directly to a beach—barges, floating piers, and temporarily installed elevated piers. Temporary piers, sometimes translated as “trestle piers” (栈桥码头), may be combined with large barges at the end of the piers to berth ships, forming a mobile port. In some environments, temporary piers would be impractically long to reach the deep water required for large ships. Therefore, Chinese military experts say the PLA must also have the capability to set up a “floating offshore sea base” (海上浮动卸载基地) in relatively safe areas offshore to transfer heavy equipment from a large RO-RO or other cargo ships to smaller vessels suitable for a direct beach landing. Mother ships or barges with cranes may also be necessary for unloading containers, vehicles, or other cargo onto smaller ships. Finally, rapid port and harbor repair capabilities may be necessary to establish provisional unloading points in damaged ports.<sup>9</sup>

A 2020 PLA exercise featured most of these logistics capabilities. Operations ranged from offloading cargo and rolling stock at a rudimentary port facility to the use of relocatable floating piers. Floating piers were combined with a large, semi-submersible barge to form a mobile port. The exercise also featured offshore loading and unloading of RO-RO and general cargo vessels using deck barges and floating cranes to unload cargo offshore. Landing craft ferried cargo and equipment from the offshore floating bases to a beach.

### **2020 JLSF Amphibious Logistics Exercise**

In the summer of 2020, the PLA's Joint Logistics Support Force (JLSF) conducted a complex logistics exercise named EASTERN TRANSPORTATION-PROJECTION 2020A (东部运投—2020A). According to a banner that appeared in a video covering the exercise, this was “military-civil joint training” (军地联合训练), making it a “military-civil fusion” (MCF) event.<sup>10</sup> This exercise provides insights about Chinese capabilities to conduct over-the-shore logistics in support of a Taiwan invasion or other large-scale military lift operation.

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<sup>7</sup> 陈炫宇, 任聪, 王凤忠 [Chen Xuanyu, Ren Cong, and Wang Fengzhong], 渡海登岛运输勤务保障面临的问题和对策 [“Countermeasures for Problems in Logistical Support in Cross-strait and Beach Landing Transportation”], 物流技术 [Logistics Technology], 35 no. 10 (2016), 168.

<sup>8</sup> Wang and Wang, “Application of Transportation and Projection Power to the Opening of Landing Bases Guangdong,” 13.

<sup>9</sup> 陈发智, 李晓楠 [Chen Fazhi and Li Xiaonan], 登岛作战中军交运输保障几个问题的探讨 [“Research into Problems of Military Transportation Support in an Island Operation”], 国防交通工程与技术 [National Defense Transportation Engineering and Technology] no. 1 (2005), 4. See also, Wang and Wang, “Application of Transportation and Projection Power to the Opening of Landing Bases Guangdong,” 13.

<sup>10</sup> The Chinese term “运投” appears to be uniformly translated into English by Chinese military authors as “transportation and projection.” “军地” refers to 军方-地方 (Military force and local (civilian) force), making this exercise a military-civil fusion (MCF) event. 联合训练 means “joint training.”

A detailed analysis of publicly-available sources including media reporting, civilian ship AIS tracking data, and commercial satellite imagery reveals that the exercise took place over two months between June and August 2020. A major focus of the exercise appeared to be the training and integration of civilian ships into military logistics operations. These ships included large RO-RO ferries, general cargo ships, a semi-submersible barge normally used in port construction, tugs, deck barges, a floating crane, and possibly fishing boats. Cargo and equipment offloaded by the civilian ships was not limited to benign materiel. Tanks and other armored vehicles were discharged directly onto a beach from a civilian ferry using the floating pier.

A one-minute video posted on Chinese government social media in August 2020 provides a useful starting point for an analysis of the event.<sup>11</sup> PLA JLSF uniform shoulder patches are clearly visible in the video. Name placards show a Senior Colonel Wang Pengyu (王鹏宇) and Colonel Wang Qiang (王强) prominently seated at the center of the exercise viewing area. A 2019 *PLA Daily* article identified these officers as the director and political commissar respectively of an unspecified JLSF “Eastern Theater Dispatch Center” (东部战区某调度中心).<sup>12</sup> This dispatch center is likely subordinate to the Wuxi Joint Logistics Support Center (无锡联勤保障中心) that provides coordination and command of military and civilian logistics support in the Eastern Theater.

Staff from the Eastern Theater JLSF almost certainly led this joint military-civilian exercise. In the video, Colonel Wang Qiang offered remarks about training objectives. He stated that the exercise demonstrated the PLA had the ability to use any port or ship, not just military ports and ships, to rapidly transport PLA personnel and equipment in support of combat operations. In addition to goals to improve the loading time of ships, Colonel Wang emphasized safety and the need to exercise logistics operations with civil participants to prevent accidents in future operations.<sup>13</sup>

Analysis of information gleaned from the video, including signage, ship names, and background features, indicates the exercise took place in Lianyungang, Jiangsu province. Lianyungang is a port city in the far northeastern corner of the PLA’s Eastern Theater, 90 nautical miles southwest of Qingdao. Subsequent analysis shows that Lianyungang served as the embarkation port for the exercise. Lanshan, a district of Rizhao city, approximately 22 nautical miles north of Lianyungang, served as the exercise objective. Lanshan features a dry bulk cargo terminal quay used for RO-RO offloading as well as a beach in a protected harbor where offshore unloading and amphibious landings took place (Figure 1).<sup>14</sup>

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<sup>11</sup> 东部战区军地联合演练跨海投送 [“Eastern Theater Command Military-Civil Joint Exercise [of] Cross Sea Projection”], 央视军事 [CCTV Military], August 13, 2020, <https://www.bilibili.com/s/video/BV1va4y1J7aU>.

<sup>12</sup> 张飞, 周鹏 [Zhang Fei and Zhou Peng], 联合投送能力的增长点在哪里—东部战区运输投送座谈交流发言集锦 [“Where are the Growth Points for Joint Projection Capabilities—A Collection of Speeches and Exchanges on Transportation and Projection in the Eastern Theater”], 解放军报 [*PLA Daily*], November 22, 2019, 3, [http://www.81.cn/gfbmap/content/2019-11/22/content\\_248065.htm](http://www.81.cn/gfbmap/content/2019-11/22/content_248065.htm).

<sup>13</sup> “Eastern Theater Command Military-Civil Joint Exercise [of] Cross Sea Projection,” 0:38-0:57.

<sup>14</sup> Lanshan is just across the border in Shandong province, placing it in the PLA’s Northern Theater. Google Earth Pro 7.3.3.7786, September 27, 2020, Lanshan, China, 35.123N 119.378E, Maxar Technologies 2021.

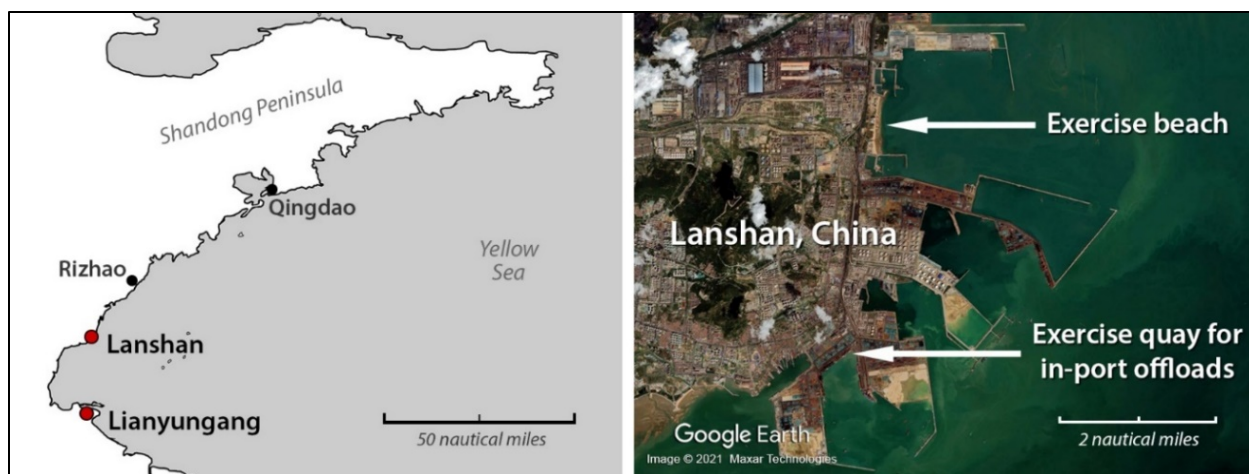


Figure 1. Map of Exercise Ports and Lanshan Overview Image (Google Earth/Maxar)

### *Participating Vessels*

The 2020 exercise involved two dozen different commercial ships, tugs and military landing craft, most of which rotated in and out of the exercise to conduct specific events over the course of the six-week operational phase of the exercise. Many of the participating ships are owned by companies or subsidiaries of Chinese state-owned enterprises such as the China Ocean Shipping Group (COSCO), Sinotrans, and the China Communications Construction Company (CCCC), specifically, the CCCC Third Navigation Engineering Bureau.<sup>15</sup>

Six RO-RO ferries from the Bohai Ferry Group, a privately-owned shipping corporation and the largest ferry operator in Asia, also participated in the exercise. According to the Bohai Ferry Group website, their ships have been built to national defense standards and have been organized into the “Eighth Transport Dadui” (海运八大队), part of China’s maritime militia strategic projection support ship fleet (战略投送支援船队) (Figure 2).<sup>16</sup> The strategic projection support ship fleet is “responsible for force projection and logistics support in diversified military missions,” including combat operations.<sup>17</sup> A maritime militia affiliation of the state-owned enterprise ships (e.g. COSCO and CCCC) used in the exercise could not be determined.

In addition to the civilian vessels, as many as eight utility landing craft (LCU), four Type 271 (*Yupen*) LCU, and three to four Type 067 (*Yunnan*) LCU also participated. Table 1 lists ships observed participating in exercise EASTERN TRANSPORTATION-PROJECTION 2020A.

<sup>15</sup> Ownership and registration information for commercial vessels obtained from MarineTraffic—Global Ship Tracking Intelligence ([www.marinetraffic.com](http://www.marinetraffic.com)), accessed April 2021. Affiliation of LCUs with PLAN Eastern Theater based on an analysis of AIS position data that indicates LCUs are likely homeported in Nan’ao Island (难熬岛), Niushiwan (牛屎湾), Qinying’ao (亲营澳), and Xiamen (厦门).

<sup>16</sup> 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>.

<sup>17</sup> 何国本, 邹伟, 鲍文华, 陈龙 [He Guoben, Zou Wei, Bao Wenhua, and Chen Long], 战略投送支援船队训练现状及对策 [“Current Situation and Countermeasures of Strategic Projection Support Fleet Training”], 军事交通学院学报 [Journal of Military Transportation University], no. 5 (May 2017), 1, as cited in Conor Kennedy, “Civil Transport in PLA Power Projection,” China Maritime Report No. 4, U.S. Naval War College, (December 2019), 7, <https://digital-commons.usnwc.edu/cmsi-maritime-reports/4>.



Table 1. Ships Participating in EASTERN TRANSPORTATION-PROJECTION 2020A

Ship Name	Type	Length / Gross Tonnage	Owner
BANG CHUI DAO	RO-RO	443 ft / 15,500 t	China Shipping Passenger Liner Co. (COSCO)
HAI YANG DAO	RO-RO	443 ft / 15,500 t	China Shipping Passenger Liner Co. (COSCO)
SHENG TAI	Gen Cargo	323 ft / 4,000 t	China COSCO Shipping Corp.
BO HAI BAO ZHU	RO-RO	538 ft / 24,000 t	Shandong Bohai Ferry Co. (Bohai Ferry)
BO HAI MA ZHU	RO-RO	590 ft / 33,400 t	Shandong Bohai Ferry Co. (Bohai Ferry)
BO HAI YIN ZHU	RO-RO	529 ft / 19,800 t	Shandong Bohai Ferry Co. (Bohai Ferry)
BO HAI ZHEN ZHU	RO-RO	538 ft / 24,000 t	Shandong Bohai Ferry Co. (Bohai Ferry)
SHENG SHENG 1	RO-RO	394 ft / 10,300 t	Weihai Haida Passenger Trans. (Bohai Ferry)
ZHONG HUA FU XING	RO-RO	696 ft / 45,000 t	Weihai Haida Passenger Trans. (Bohai Ferry)
TIAN ZHU SHAN	Gen Cargo	323 ft / 4,000 t	Shanghai Changjiang Shipping (Sinotrans)
SAN HANG GONG 8	Heavy Lift	213 ft / Unk.	China Communications Construction Co.
SAN HANG TUO 4007	Tug	147 ft / 842 t	China Communications Construction Co.
SAN HANG TOU 2007	Tug	105 ft / Unk.	China Communications Construction Co.
SAN HANG TUO 1009	Tug	108 ft / Unk.	China Communications Construction Co.
WISH WAY (*possible)	Heavy Lift	512 ft / 16,600 t	China Communications Construction Co.
JIN XU 9	Unknown	Unknown	Unknown
4 x Type 271 LCU	Landing Craft	185 ft / 800 t	PLA Eastern Theater Navy
3-4 x Type 067 LCU	Landing Craft	93 ft / 135 t	PLA Eastern Theater Navy



Figure 2. RO-RO Ferry ZHONG HUA FU XING (Bohai Ferry Group)

## Amphibious Logistics Capabilities and Technologies

A number of novel amphibious capabilities and technologies used to integrate civilian shipping into amphibious operations were identified in commercial satellite imagery during the 2020 JLSF exercise.

### *Modular Floating Pier*

The opening line of a Chinese news article about the August 2020 exercise set the stage for its coverage of the training event: “A loading and unloading joint command post is opened. Roll-on and hoisting lines of operation expand synchronously. When the formation of ferries arrives at a certain sea area, a multi-mode temporary pier (多方式临时码头) is set up to quickly unload and land...”<sup>18</sup> That “temporary pier” figured prominently in Exercise EASTERN TRANSPORTATION-PROJECTION 2020A. It allowed RO-RO ferries to discharge armor and rolling stock directly to a beach landing area.

The temporary pier, what the PLA have called an “offshore mobile unloading platform” (海上机动卸载平台), was noted in commercial satellite imagery in Lanshan in September 2020.<sup>19</sup> Images show modules for two floating piers—a 1,200-foot (366-meter) pier and a 720-foot (220-meter) pier. Also seen are associated cargo ferries and barges as well as warping tugs that maneuver pier modules into place (Figure 3). The Chinese system, especially with its ferries and warping tugs, appears similar to the U.S. Navy’s Improved Navy Lighterage System (INLS).<sup>20</sup>

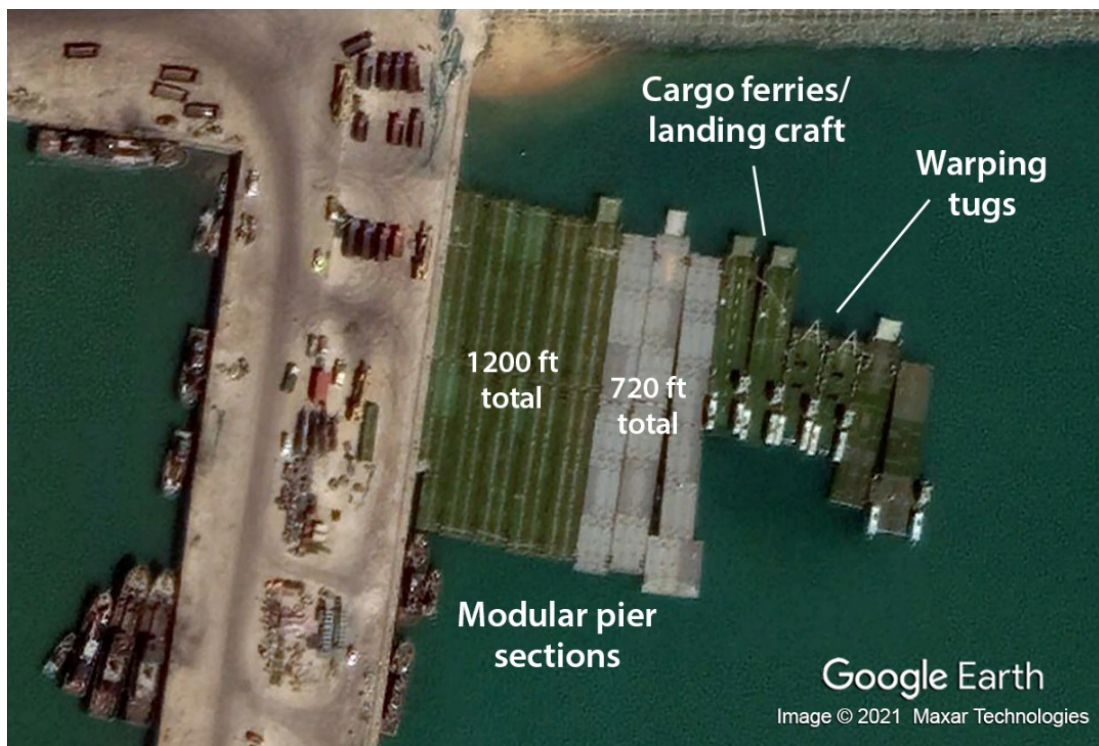


Figure 3. Chinese Modular Floating Pier System in Lanshan, China, 27 September 2020 (Google Earth/Maxar)

<sup>18</sup> 汤金荣, 周鹏, 陈峰 [Tang Jinrong, Zhou Peng and Chen Feng], 跨海投送 [“Cross-Sea Projection”], 中国青年报 [China Youth Daily], August 27, 2020, [http://m.cyol.com/yuanchuang/2020-08/27/content\\_18752048.htm](http://m.cyol.com/yuanchuang/2020-08/27/content_18752048.htm).

<sup>19</sup> Google Earth Pro 7.3.3.7786, Sep. 27, 2020, Lanshan, China, 35.137N 119.378E, Maxar Technologies 2021.

<sup>20</sup> “Improved Naval Lighterage System,” Fincantieri Marine Group, accessed 27 April 2020, <https://fincantierimarinegroup.com/products/navy/improved-navy-lighterage-system/>.

In 2001, China's National Defense Mobilization Committee reportedly ordered the development of an "offshore mobile unloading platform" as one of the major projects under "Project 019" (019 工程). The PLA Military Transportation University's Military Transportation Research Institute (军事交通研究所) was tasked to develop a prototype offshore unloading platform. The expressed purpose of the project was to create a capability for at-sea transfer and unloading of vehicles and materiel when ports had been destroyed by "blue forces." To design the unloading platform, "more than 20,000 pages of foreign language materials were collected, translated and sorted."<sup>21</sup> Design specifications for the U.S. INLS were almost certainly among those foreign language materials.

The prototype system comprised "square" or intermediate pontoon modules, bow-stern modules, ramp modules, propulsion modules, and electrical supply modules. These are the same types of modules that make up the U.S. Navy INLS. The Chinese offshore mobile unloading platform that was eventually built appears to be just a causeway without propulsion or electrical supply modules. Patent documents indicate the proposed system can operate in sea state 3 (wave height up to 4 feet), which is identical to the advertised operating limit of the U.S. Navy INLS.<sup>22</sup>

The offshore mobile unloading platform was first shown publicly in a television news report highlighting a 2014 Guangzhou Military Region exercise. The exercise was reportedly the first time the PLA used a civilian RO-RO ferry to offload a PLA unit using the system. As the ferry made its way from the southern port city of Zhanjiang, the embarked PLA mechanized infantry company received word from exercise coordinators that its destination terminal was damaged and was ordered to offload over-the-beach using the floating pier system that was being assembled (Figure 4).<sup>23</sup>

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<sup>21</sup> 叶贵先 [Ye Guixian], 解放军装备海上机动卸载平台增强后勤保障能力 ["The PLA is Equipped with an Offshore Mobile Unloading Platform to Enhance Logistics Support"], 光明日报 [*Guangming Daily*], April 27, 2005, <http://jczs.sina.com.cn/2005-04-27/1823283991.html>.

<sup>22</sup> Wang Guangdong in association with the Military Transportation Research Institute appears to hold dozens of patents for various marine logistics related inventions and devices many of which are related to the floating pier system. See for example, Inventor: 王广东 [Wang Guangdong] et al, 复合滚装/滚卸跳板 ["Composite Roll-On/Roll-Off Gangplank"], PRC Patent CN2915928Y, filed June 13, 2006 and issued June 27, 2007, <https://patents.google.com/patent/CN2915928Y/zh>; Inventor: 王广东 [Wang Guangdong] et al, 海上多用途浮箱 ["Offshore Multi-Use Buoyancy Tank"], PRC Patent CN101209746A, filed December 25, 2007 and issued June 9, 2010, <https://patents.google.com/patent/CN101209746A/zh>; Inventor: 王广东 [Wang Guangdong] et al, 海上浮箱系统的刚性连接接头 ["Rigid Connector of Offshore Floating Casing System"], PRC Patent CN2871946Y, filed March 15, 2006 and issued February 21, 2007, <https://patents.google.com/patent/CN2871946Y/zh>.

<sup>23</sup> 广州军区首次民船成建制实兵装卸演练 ["Guangzhou Military Region's First Civilian Ship Full-Scale Loading and Unloading Exercise"], CCTV, June 20, 2014, 1:24, <https://news.cctv.com/2014/06/20/VIDE1403241489289947.shtml>.





Figure 4. Offshore Mobile Unloading Platform Assembled During 2014 PLA Exercise (CCTV)

Commercial satellite imagery indicates that the two floating piers used in the 2020 exercise were very similar to the offshore mobile unloading platform used in 2014. They were assembled and disassembled several times at the southern end of the Lanshan exercise beach. The longer floating pier was normally used in conjunction with the semi-submersible barge, described in the next section. AIS tracking data indicate that LCUs frequently shuttled between RO-RO ships or cargo unloading areas offshore and the shorter floating pier. LCU operations appeared to be independent from RO-RO offloading operations using the longer pier and semi-submersible barge (Figure 5).<sup>24</sup>

<sup>24</sup> See AIS position data citations for LCUs and crane offloads (note 30) and offshore RO-RO offloads (note 33). See also Planet Labs SkySat, Image ID: 20200811\_053052\_ssc8\_u0001, August 11, 2020, Lanshan, China, 35.141N, 119.379E, SkyWatch EarthCache, <https://www.skywatch.com>.



Figure 5. Assembled Short Pier at Lanshan Beach, 11 August 2020 (© 2021 Planet Labs)<sup>25</sup>

Fishing boats may have been used to assist in the assembly of the off-shore mobile unloading platforms. Satellite imagery shows pier modules interspersed with what appear to be fishing vessels in the harbor where the piers modules were staged (Figure 6).<sup>26</sup>

<sup>25</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>26</sup> Planet Labs SkySat, Image ID: 20200801\_053655\_ssc10\_u0001, August 1, 2020, Lanshan, China, 35.138N, 119.384E, SkyWatch EarthCache, <https://www.skywatch.com>.





Figure 6. Probable Fishing Boats Interspersed with Modular Floating Pier Sections, 1 August 2020 (© 2021 Planet Labs)<sup>27</sup>

#### *Semi-Submersible Barge Forming an Artificial Port*

The 2020 exercise included a large semi-submersible barge identified as the SAN HANG GONG 8 (三航工 8). When the barge was attached to the floating pier, the combination formed an artificial port (人工港) where ships could be moored, resupplied and offloaded. In comments to the media, one of the PLA exercise participants stated that the semi-submersible barge served as a temporary marine dock and was used for berthing and unloading RO-RO ferries.<sup>28</sup>

Video from the 2014 amphibious exercise in the Guangzhou Military Region (discussed above) shows a semi-submersible barge very similar to the SAN HANG GONG 8 submerging to offload a warping tug and then maneuvering into place at the end of the floating pier (Figure 7). The barge's freeboard (its height above water) can be adjusted to accommodate different types of vessels. In the video, a civilian RO-RO ferry, the NAN FANG 6, docked with the barge and quickly discharged armored vehicles and trucks that then proceeded to the beach over the floating pier (Figure 8).<sup>29</sup>



Figure 7. Semi-Submersible Barge Used with Floating Pier in 2014 Exercise (CCTV)

<sup>27</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>28</sup> Tang et al, "Cross-Sea Projection."

<sup>29</sup> "Guangzhou Military Region's First Civilian Ship Full-Scale Loading and Unloading Exercise," 1:32.



Figure 8. Civilian Ferry Offloading Armored Vehicles to Beach in 2014 Exercise (CCTV)

Identical unloading activities apparently took place during the 2020 logistics exercise in Lanshan. The video of the 2020 exercise shows tanks and armored vehicles exiting from the SHENG SHENG 1 and crossing the SAN HANG GONG 8 onto the floating pier in the foreground (Figure 9).<sup>30</sup>



Figure 9. RO-RO Ferry SHENG SHENG 1 Unloading Tanks onto Semi-Submersible Barge and Floating Pier during Exercise EASTERN TRANSPORTATION-PROJECTION 2020A (CCTV)

### *Mat Roadway for Beach Access*

Satellite imagery in Figure 5, above, shows a dark strip running between the end of the floating pier and a parking lot on the other side of the beach. While this strip cannot be positively identified in imagery, it is probably a metal or synthetic mat roadway that was laid down to prevent heavy wheeled or tracked vehicles from sinking in soft sand or mud. The 2014 Guangzhou Military Region exercise video shows a metal mat roadway being laid to the end of the floating pier.<sup>31</sup> Harzone, the

<sup>30</sup> 东部战区军地联合演练跨海投送 [“Eastern Theater Command Military-Civil Joint Exercise [of] Cross Sea Projection”], video, 0:53-0:57. The video of the tanks offloading likely took place on August 3, 2020.

<sup>31</sup> “Guangzhou Military Region’s First Civilian Ship Full-Scale Loading and Unloading Exercise,” 1:46.



division of the China Shipbuilding Industry Corporation (CSIC) responsible for manufacturing military bridging equipment and pontoon bridges, produces a “fast hard road paver” that deploys a roll of aluminum matting and a “fast soft road paver” that deploys a roll of reinforced polyester fabric as a mat roadway (Figure 10).<sup>32</sup>



Figure 10. Metal Mat Roadway Installation Shown in the 2014 Exercise Video (left) and Photo from the Harzone Product Catalog of a Fast Soft Road Paver (right) (CCTV/Harzone)

### *Floating Crane for Offshore Loading/Unloading*

Throughout the 2020 exercise, a floating crane was anchored in the center of the harbor approximately 1.2 nautical miles east of the landing beach. From commercial satellite imagery, this appears to be a civilian harbor crane, a 90-foot (27-meter) crane mounted atop a deck barge measuring 265 x 80 feet (80 x 24 meters) (Figure 11).<sup>33</sup> AIS tracking data indicates that two different general cargo ships came alongside this crane several times during the exercise, presumably to load or unload cargo. In 17 August 2020 imagery, six vehicles appear to be parked on the deck of the crane barge. These vehicles may have been staged for loading on to a ship during operations that would take place two days later. Alternatively, the vehicles may have been there to receive cargo from a ship. In the latter case, the vehicles would then drive onto an LCU for transport to the floating pier where they could be quickly discharged. During probable cargo offloading operations, LCUs ran between the crane’s location and the short floating pier assembled at the south end of the beach.<sup>34</sup>

<sup>32</sup> China Harzone Industry Corp., *Harzone Catalogue*, (Wuhan, China: Harzone Industry Corp, 2018), 27-30.

<sup>33</sup> Planet Labs SkySat, Image ID: 20200715\_053516\_ssc8\_u0001, July 15, 2020, Lanshan, China, 35.148N, 119.401E, and Image ID: 20200817\_023322\_ssc12\_u0001, August 17, 2020, Lanshan, China, 35.148N, 119.401E, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>34</sup> For example, AIS position data, probable LCU (MMSI 413469786), August 3, 2020, and probable LCUs (MMSI 412357406, 412175175), August 10, 2020, and probable LCUs (MMSI 412175175, 412170701), August 19, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

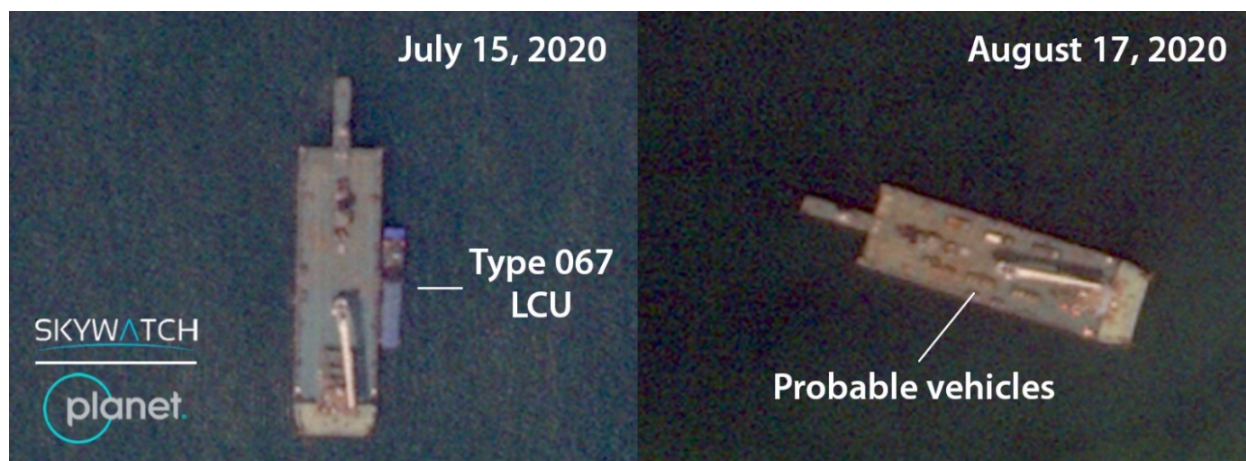


Figure 11. Floating Crane Barge Anchored in Center of Lanshan Exercise Harbor (© 2021 Planet Labs)<sup>35</sup>

### *RO-RO Offshore Unloading Platform*

For several seconds during the video report on the 2020 exercise, two PLA officers are seen examining a display that presumably showed capabilities demonstrated during the exercise. According to text visible on the display, the capability being discussed involved two large engineering side barges (大型工程方驳), four Type 271 LCUs and one “pier ferry” (栈桥渡船), which may be the current term used for the floating pier system.<sup>36</sup> Other text visible in the display indicates the barges, which together measure 427 x 49 feet (130 x 15 meters), may be used to unload wheeled and tracked vehicles from RO-RO ferries.

Two 213-foot (65-meter) deck barges were seen in satellite imagery linked together as one 427-foot (130-meter) barge (Figure 12).<sup>37</sup> Ramps appeared to have been affixed to the sides of the barges probably to allow LCUs to come alongside the barge for loading. During the exercise, tugs maneuvered the barge behind RO-RO ferries anchored approximately two nautical miles offshore presumably to facilitate loading or offloading of vehicles. AIS tracks indicate that Type 271 and Type 067 LCUs moved between the location of the barge and the short floating pier at the southern end of the exercise beach during these operations.<sup>38</sup>

<sup>35</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>36</sup> A better Chinese term used in the maritime industry for what the PLA is calling a 型工程方驳 (engineering side barge) is probably 甲板驳船 (deck barge).

<sup>37</sup> Planet Labs SkySat, Image ID: 20200801\_053655\_ssc10\_u0001, August 1, 2020, Lanshan, China, 35.147N, 119.409E and Image ID: 20200811\_053052\_ssc8\_u0001, August 11, 2020, Lanshan, China, 35.138N, 119.383E, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>38</sup> For example, AIS position data, probable LCUs (MMSI 412175175, 412357400, 412357406, 412357407), August 3, 2020, and probable LCUs (MMSI 413366060, 412175175, 413469786, 412357400, 412357406, 412357407), August 19, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

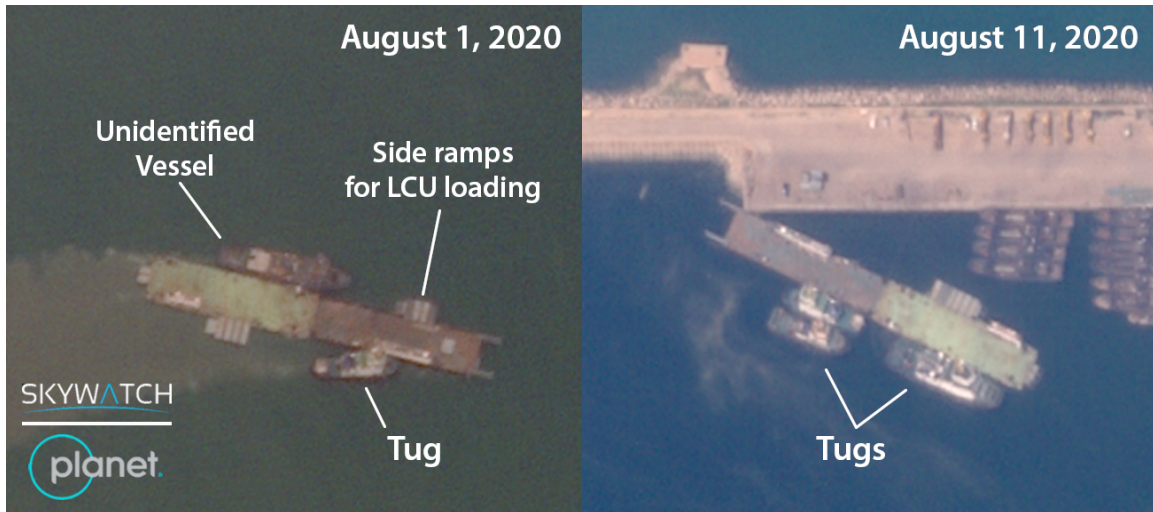


Figure 12. Deck Barges Used as RO-RO Ferry Offshore Unloading Platforms (© 2021 Planet Labs)<sup>39</sup>

#### *PLAN Landing Craft*

Type 271 and Type 067 LCUs deployed to Lanshan for the exercise from bases in southern Fujian province. These LCUs operated in the Lanshan harbor and beach area throughout the exercise period. Commercial satellite imagery on 17 August 2020 shows eight LCUs in the fishing harbor south of the exercise beach (Figure 13).<sup>40</sup> Recognition features and measurements establish that four Type 271 LCU and three Type 067 LCU are present. Another possible LCU, with what appears to be a more substantial superstructure, longer than the Type 067s at approximately 145 feet (44 meters), is moored alongside the other LCUs. An LCU of this size could not be identified in the PLA inventory from available sources. The LCUs conducted multiple landings directly on the beach during the exercise.<sup>41</sup>

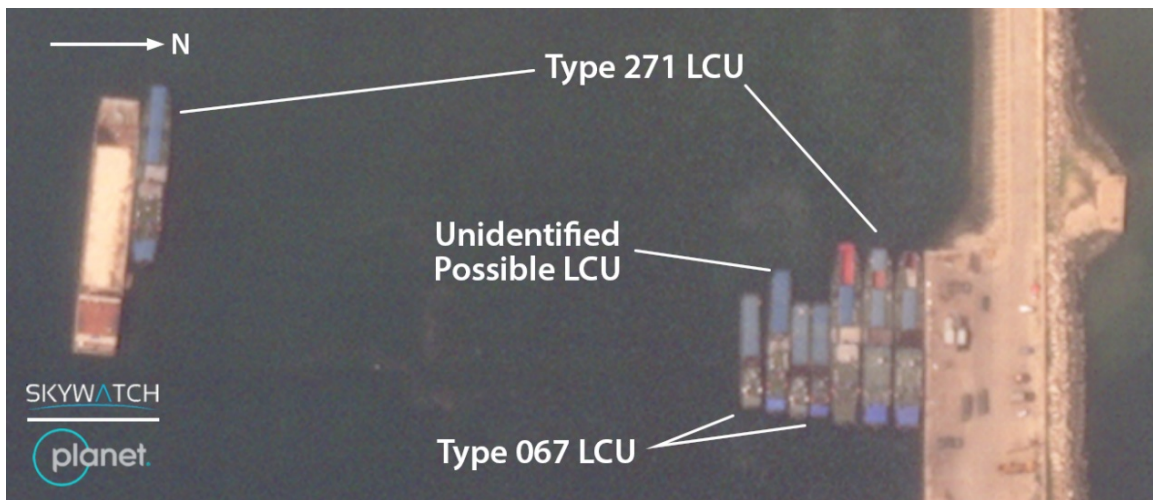


Figure 13. LCU's in Fishing Harbor South of Exercise Beach, 17 August 2020 (© 2021 Planet Labs)<sup>42</sup>

<sup>39</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>40</sup> Planet Labs SkySat, Image ID: 20200817\_023322\_ssc12\_u0001, August 17, 2020, Lanshan, China, 35.138N, 119.383E, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>41</sup> For example, AIS position data, probable LCU (MMSI 412357407) and probable LCU (MMSI 412170701), July 7, 22, 24 and August 5, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>42</sup> Includes content sourced via SkyWatch Space Applications Inc.



In addition to the LCUs using the short floating pier system to offload vehicles and equipment, dredging of select areas appears to have allowed LCUs to directly land on the beach without concern for getting stranded on the mud flats at low tide (Figure 5, above). Cargo ferries associated with the floating pier system also conducted beach landings. Satellite imagery shows a cargo ferry that had probably just discharged vehicles onto the beach. It also shows an apparent mat roadway crossing the beach (Figure 14).<sup>43</sup>



Figure 14. Floating Pier System Cargo Ferry Landing at Exercise Beach, 15 July 2020 (© 2021 Planet Labs)<sup>44</sup>

The apparent use of the short floating pier system by landing craft across the mud flats at Lanshan beach is notable. Much of Taiwan's shoreline has been deemed unsuitable for amphibious landings because of tidal variations similar to Lanshan (~12 feet). Mud flats in northwest Taiwan extend several hundred feet from the shore allowing only a narrow window for landing at high tide before the receding water would otherwise strand LCUs or larger landing ships on the flats. Figure 15 shows a comparison of the Lanshan exercise beach to a beach representative of the northwest Taiwan coastline seven nautical miles southwest of the Hsinchu military airbase.<sup>45</sup>

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<sup>43</sup> Planet Labs SkySat, Image ID: 20200817\_023322\_ssc12\_u0001, August 17, 2020, Lanshan, China, 35.138N, 119.383E, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>44</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>45</sup> Google Earth Pro 7.3.3.7786, (left to right) February 19, 2021 and September 27, 2020, Lanshan, China, 35.145N 119.379E; July 10, 2020 and September 19, 2017, Zhunan, Taiwan, 24.705N, 120.860E, Maxar Technologies 2021.



Figure 15. Comparison of Mud Flats Extending from Lanshan Exercise Beach (left) and Representative Beach in Northwest Taiwan (right) (Google Earth/Maxar)

## 2020 JLSF Exercise Summary

Exercise EASTERN TRANSPORTATION-PROJECTION 2020A took place from mid-June to late-August 2020. The exercise progressed in increasingly complex stages over two months. Figure 16 and Table 2 outline the exercise timeline, highlighting exercise events organized around notional exercise phases.

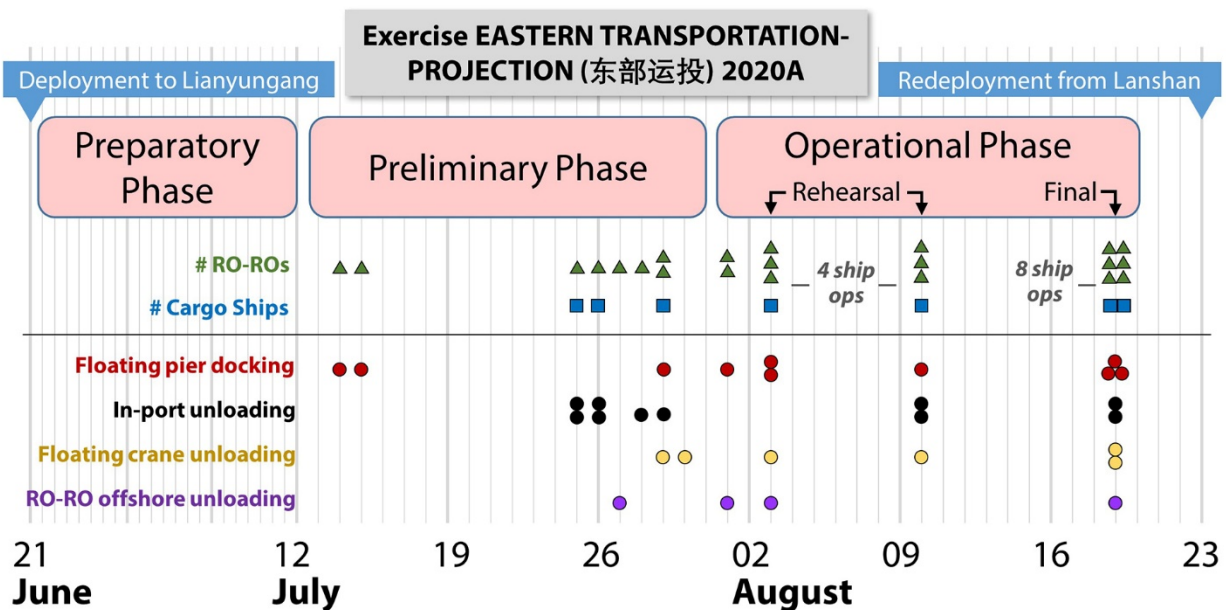


Figure 16. Observed Timeline for Exercise EASTERN TRANSPORTATION-PROJECTION 2020A

Table 2. Observed Timeline for Exercise EASTERN TRANSPORTATION PROJECTION 2020A

Exercise Phase	Dates (2020)	Major Events
Deployment	June 13-21	RO-RO ferry transports JLSF and forces to Lianyungang
Preparatory	June 21-July 13	Probable unit-level training of cargo/vehicle loading, crane operations, etc.; LCU's conduct landings at Lanshan beach
Preliminary	July 14-31	Commercial ships observed individually practicing capabilities including docking with the barge/floating pier, offloading in port and offloading at the floating crane and the offshore platform
Operational	August 1-20	
1 <sup>st</sup> Half Rehearsal	August 2-3	4-ship ops: 3 x RO-RO ferries offload at floating pier and with off-shore platform; 1 x cargo ship offloads at floating crane
2 <sup>nd</sup> Half Rehearsal	August 9-10	4-ship ops: 3 x RO-RO ferries off-load at floating pier and in port; 1 x cargo ship offloads at floating crane
Final Evolution	August 18-20	8-ship ops: 3 x RO-RO ferries dock with floating pier; 1 x RO-RO ferry offloads with off-shore platform; 2 x RO-RO ferries offload in Lanshan port; 2 x cargo ships off-load at floating crane
Re-deployment	August 21-25	RO-RO ferry transports JLSF and equipment back to port of origin; semi-submersible barge redeploys to southern Taiwan Strait area.

#### *Exercise Deployment*

On June 13, 2020, the HAI YANG DAO left its normal route ferrying passengers across the mouth of the Bohai Gulf. The 15,500-ton RO-RO ferry traveled 900 nautical miles south to a nondescript container terminal in Jiangyin Town (江阴镇), Fujian province, 35 nautical miles south of Fuzhou and just across the harbor from Putian. There, on 19 June, the HAI YANG DAO probably picked up staff from the JLSF Eastern Theater Dispatch Center as well as equipment, vehicles and cargo that would be used in the exercise. Two days later, the HAI YANG DAO called in the exercise embarkation port of Lianyungang for five hours, probably to offload the exercise participants. The ship then immediately returned to its regular ferry route across the Bohai (Figure 17).<sup>46</sup>

<sup>46</sup> AIS position data, HAI YANG DAO (MMSI 412468000), June 13-21, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

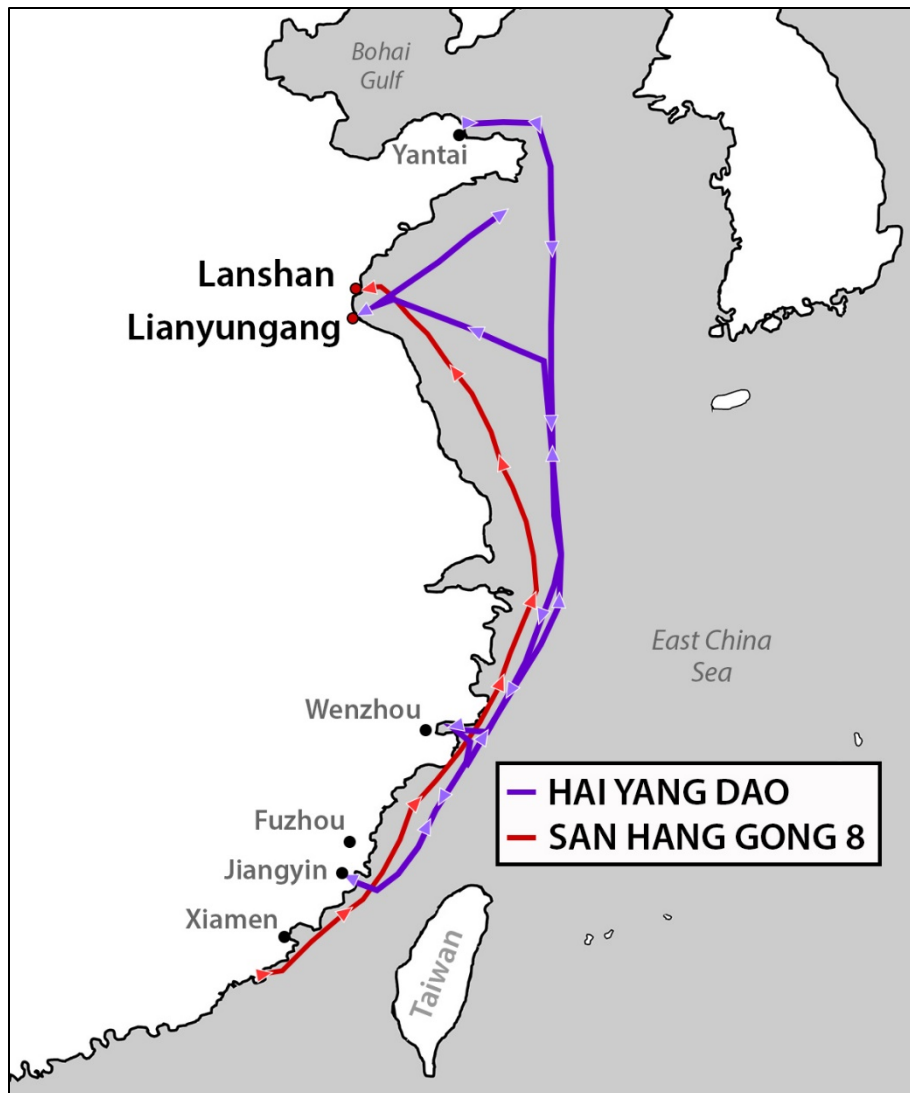


Figure 17. Transits of HAI YANG DAO and SAN HANG GONG 8, 13-21 June 2020

When the HAI YANG DAO left the Shandong Peninsula, the large semi-submersible construction vessel, SAN HANG GONG 8, probably towed by the tug SAN HANG TUO 4007, began its long march from a port construction project south of Xiamen, Fujian. The two vessels made way at between 5 and 8 knots over the course of a week to arrive in Lanshan on 19 June.<sup>47</sup> The long (and probably expensive) transit of this heavy semi-submersible barge to and from southeastern China is curious, especially considering that a very similar semi-submersible vessel was in Lanshan at the time of the exercise.<sup>48</sup>

<sup>47</sup> AIS position data, SANHANGGONG8 (MMSI 413378280) and SAN HANG TUO 4007 (MMSI 412704260), June 13-19, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>48</sup> For the entire exercise period, a semi-submersible barge virtually identical to the SAN HANG GONG 8 loitered in the northern part of the Lanshan Beach inner harbor. This barge was identified as the ZHONG JIAN BAN QIAN BO 1 (MMSI 413326830), which appears to be homeported in Lanshan. Other than its presence in the exercise beach area, nothing indicated it participated in the exercise.



For all exercise events, participating ships transited from the port of embarkation, Lianyungang, to the exercise objective, Lanshan. All ships followed established routes for entering and exiting those ports and harbors. The majority of exercise events happened during daylight hours. For each major training evolution, ships loaded or unloaded in Lianyungang on one day and departed before nightfall. The ships then stopped overnight at an anchorage, usually near Lanshan. They departed the anchorage in the morning and proceeded to either the port or the beach area, arriving around the time for high tide. The typical route each ship took between Lianyungang and Lanshan is shown in Figure 18.

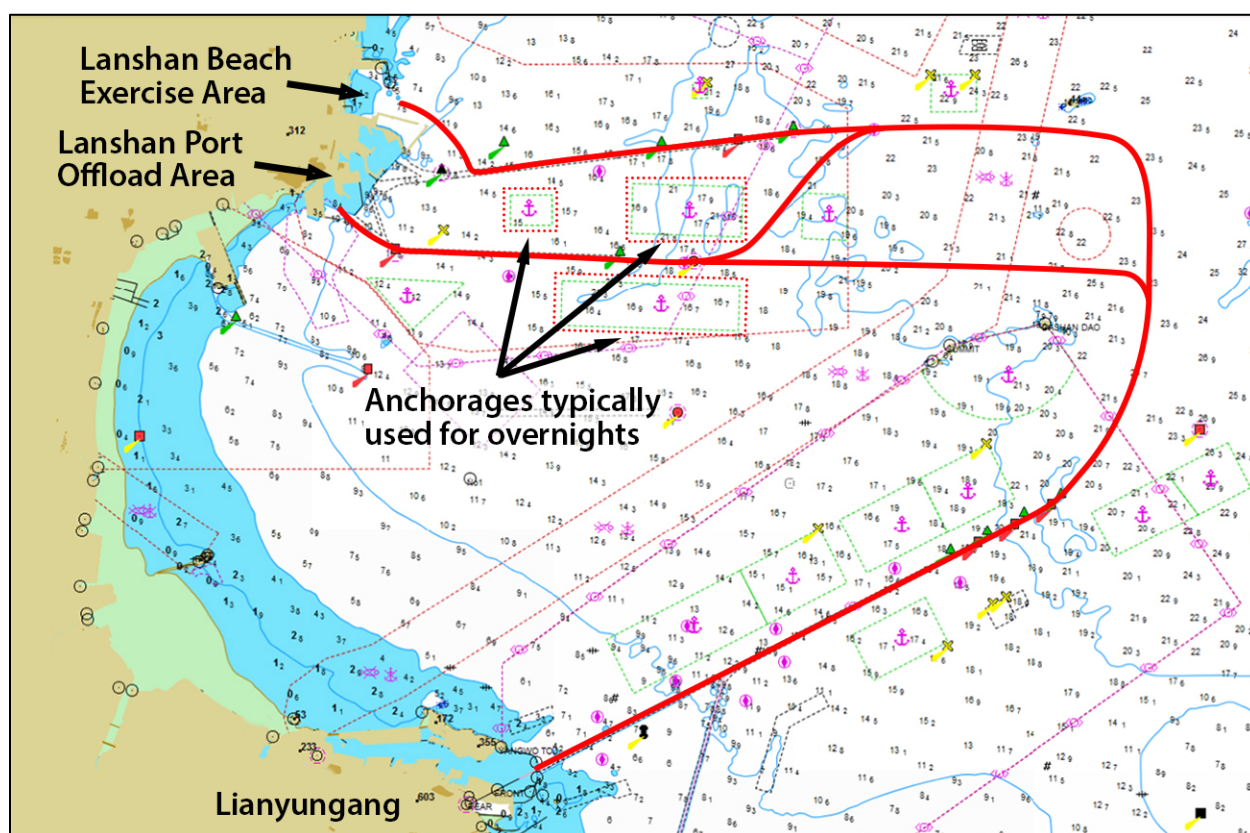


Figure 18. Typical Track of Exercise Ships Driven by Navigation Constraints

### *Preparatory Phase*

Based on the movement of commercial ships and when the JLSF and other forces arrived in Lianyungang as well as some speculation about necessary exercise preparations, the first three to four weeks of the exercise probably focused on preparing and staging equipment. Unit level training on logistics operations and ship loading also probably occurred. Training with the mobile floating piers and the semi-submersible barge appears to have been a focus during the first weeks of the exercise. Satellite imagery and AIS tracks indicate pier modules were assembled, docked with the SAN HANG GONG 8, and disassembled several times. LCUs appeared to conduct independent training including beach landings throughout this period.<sup>49</sup>

<sup>49</sup> AIS position data, SANHANGGONG8 (MMSI 413378280) and probable LCUs (MMSI 412175175, 413469786, 412170701, 413666669, 412357400, 412357406, 412357407), June 21-July 12, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

### *Preliminary Phase*

The preliminary phase of the exercise took place from July 14-31, 2020. During this phase, individual technologies and capabilities were tested and exercised. This methodical, building block approach saw individual ships, or sometimes pairs of ships, conducting operations including docking with the semi-submersible barge/floating pier, port operations, and off-shore loading/unloading operations.

#### Floating Pier Docking Operations

The first major exercise event and the first noted participation of a civilian RO-RO vessel occurred in mid-July. The SHENG SHENG 1 arrived directly from its ferry route in the Bohai on 14 July and docked with SAN HANG GONG 8 and the floating pier for four hours. SHENG SHENG 1 may have embarked vehicles, but other than the long mooring time, there are no outward indications this occurred. SHENG SHENG 1 proceeded to Lianyungang port and then returned to Lanshan to dock with the semi-submersible barge again on 15 July (Figure 19).<sup>50</sup> This event was probably intended to test procedures for docking with the floating pier, barge, and ferry. Another docking evolution took place on 29 July when the RO-RO ferry BANG CHUI DAO docked with the SAN HANG GONG 8, likely in preparation for the operational phase of the exercise.



Figure 19. RO-RO Ferry SHENG SHENG 1 Maneuvering for Stern Docking with SAN HANG GONG 8 (© 2021 Planet Labs)<sup>51</sup>

#### Port Operations

Loading and unloading operations in-port involved RO-RO ferries and general cargo ships calling in Lanshan's dry bulk cargo terminal. This cargo area probably represented an austere or damaged port facility.

From July 25-27, 2020, the 24,000-ton RO-RO ferry BO HAI BAO ZHU and the general cargo ship TIAN ZHU SHAN operated between Lianyungang and Lanshan, again, probably conducting preliminary training in advance of more complex exercise evolutions. Probable loading or unloading activity occurred quayside at the Lanshan terminal.<sup>52</sup> A review of commercial satellite imagery indicates that no special modifications were made to the area where ships moored during the exercise

<sup>50</sup> AIS position data, SHENG SHENG 1 (MMSI 412328670), July 14-16, 2020, [www.marinetraffic.com](http://www.marinetraffic.com). Planet Labs SkySat, Image ID: 20200715\_053516\_ssc8\_u0001, July 15, 2020, Lanshan, China, 35.146N, 119.380E, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>51</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>52</sup> AIS position data, BO HAI BAO ZHU (MMSI 412330020) and TIAN ZHU SHAN (MMSI 412076010), July 25-27, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).



(Figure 20).<sup>53</sup> However, a review of historical images available on Google Earth shows that this corner of the terminal has previously hosted container ships and general cargo vessels. Therefore, it is possible that Lanshan's port infrastructure and cranes were used to offload cargo for the exercise. Lanshan's 12-foot tidal range and the operating limits of the ferries' ramps probably drove the RO-RO ferries to only dock quayside at high tide.

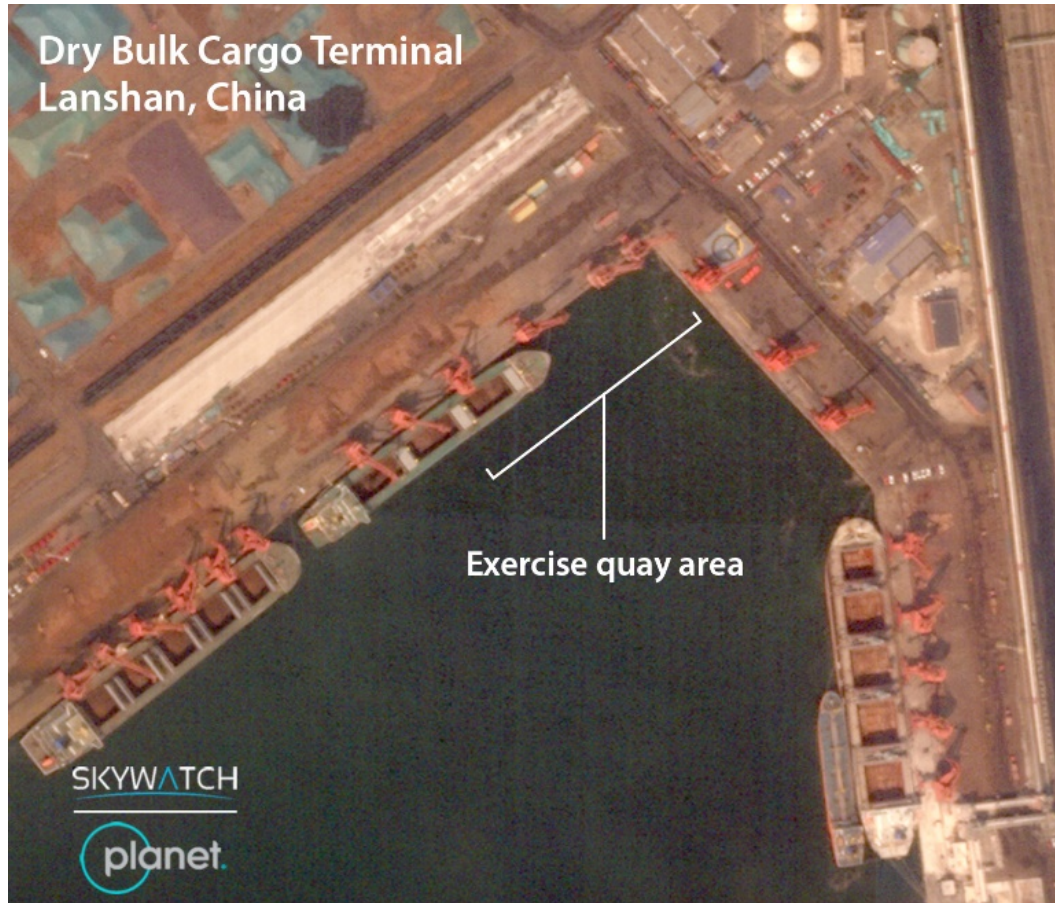


Figure 20. Lanshan Dry Bulk Terminal Quay Area Used During Exercise (© 2021 Planet Labs)<sup>54</sup>

All Chinese ferries used in this exercise—in fact, most Chinese ferries—have ramps that extend from the ships allowing them to embark or discharge vehicles onto any suitable pier or quay. This design feature differs from commercial ferries that have no ramps but instead rely on ramps at ferry terminals that lower to the ship. Even with ramps integrated onto the ships, Chinese RO-RO ferries on established routes usually call at terminals that feature docking platforms that rise and fall with the tide. Lianyungang has such a platform at its ferry terminal. For a fixed pier or quay, however, its height must likely be at or below the level of the ramp on the ferry. This would be problematic if a very low tide put the ferry's deck below the height of the pier or quay. However, as long as the tides do not exceed the operating limits of the RO-RO ferry's ramp, the ship may embark or offload vehicles in virtually any port, including damaged port facilities where specialized docks to accommodate ferries are unavailable.

<sup>53</sup> Planet Labs SkySat, Image ID: 20200817\_023322\_ssc12\_u0001, August 17, 2020, Lanshan, China, 35.096N, 119.370E, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>54</sup> Includes content sourced via SkyWatch Space Applications Inc.



### Offshore Loading/Unloading Operations

Preliminary offshore training evolutions took place immediately after in-port loading/offloading operations concluded. During the preliminary phase of the exercise, participants had been methodically working through single-ship operations (RO-RO ferry docking at the floating pier), then two-ship operations (RO-RO and cargo ships offloading in port), and finally three-ship operations with the added complexity of exercising offshore loading and unloading. Figure 21 shows the Lanshan beach exercise area. These areas are labeled based on exercise activity to provide a common frame of reference. The labels Chinese exercise participants may have given these areas are unknown.

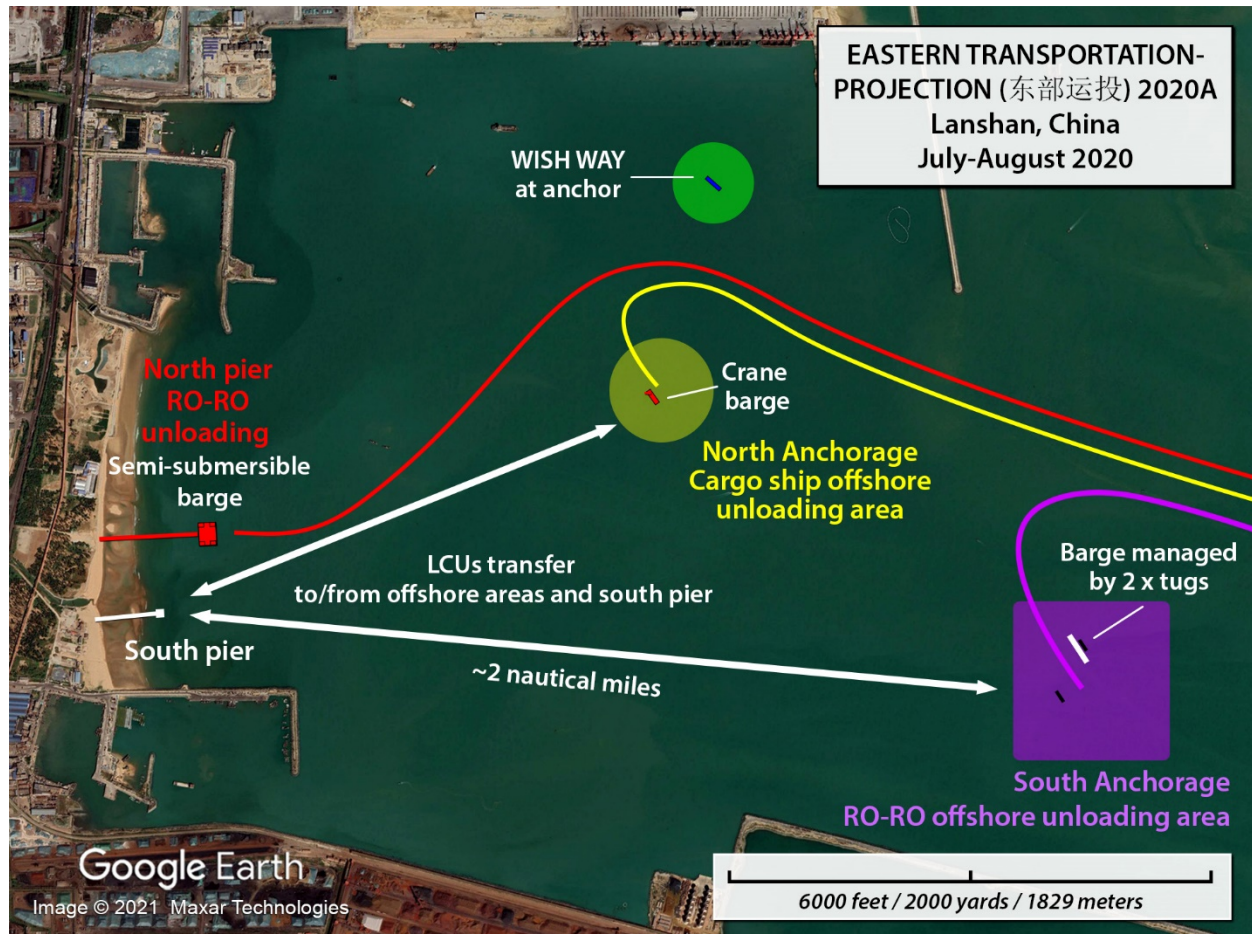


Figure 21. Functional Exercise Areas Identified at Lanshan Beach (Google Earth/Maxar)

27 July 2020: The RO-RO ferry BO HAI ZHEN ZHU arrived at the south anchorage early and remained there for over seven hours. Tugs approached the stern of the BO HAI ZHEN ZHU indicating the first use of the offshore RO-RO unloading platform (the two modified deck barges). Since the BO HAI ZHEN ZHU had arrived directly from its ferry route on the Bohai, the ship was likely empty and may have conducted on-load operations before transiting to Lianyungang.

28 July 2020: The general cargo ship TIAN ZHU SHAN arrived at the north anchorage in the morning, probably to initiate offshore crane operations. Concurrent with the crane barge evolution, the RO-RO ferry BANG CHUI DAO arrived and docked with the semi-submersible barge. During these operations, the BO HAI ZHEN ZHU also returned from Lianyungang and probably offloaded

equipment at the dry bulk cargo terminal in Lanshan port. The two RO-RO ferries departed Lanshan and returned to their respective ferry routes on the Bohai Gulf.

30 July 2020: The TIAN ZHU SHAN returned to the north anchorage, probably to continue practicing offshore loading or unloading with the floating crane.<sup>55</sup>

### *Operational Phase*

The operational phase of the exercise took place from August 1-20, 2020. This phase included four-ship groups in two different rehearsal events performing the evolutions practiced in the preliminary phase. The final exercise event occurring from 18-20 August and involved all eight ships conducting loading operations in Lianyungang and unloading operations in Lanshan, either at the port or the exercise beach.

1 August 2020: Exercise EASTERN TRANSPORTATION-PROJECTON 2020A entered its final phase with an offshore loading evolution. The WISH WAY, a large semi-submersible heavy-lift ship, arrived and anchored in the exercise harbor within 20 minutes of the arrival of the 45,000-ton RO-RO ferry ZHONG HUA FU XING, the crown jewel of the Bohai Ferry Group.<sup>56</sup> In August 2020, the ZHONG HUA FU XING was the largest ferry in Asia and had not yet entered regular commercial service on a ferry route.<sup>57</sup> The ship's first operation was apparently in service of its military obligations.

It is not clear what role the WISH WAY played in the exercise, but the coincident arrival of a ship of this type is interesting. Semi-submersibles like the WISH WAY, owned by the China Communications Construction Company (CCCC), have supported other PLA amphibious operations. These highly versatile ships may act as mobile sea bases, enabling the transfer of forces and equipment.<sup>58</sup> That said, for the most part, WISH WAY remained at its anchorage for the remainder of the exercise. In the few commercial satellite images available from 1-20 August, the WISH WAY's deck was clear in each image (Figure 22).<sup>59</sup>

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<sup>55</sup> AIS position data, BO HAI ZHEN ZHU (MMSI 413409000), BANG CHUI DAO (MMSI 412450000), and TIAN ZHU SHAN (MMSI 412076010), July 27-30, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>56</sup> AIS position data, WISH WAY (MMSI 371578000) and ZHONG HUA FU XING (MMSI 412283000), August 1, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>57</sup> "Asia's Largest "RO-RO" Passenger Cruise Ships Sets on Maiden Voyage in East Asia," *Xinhua*, October 7, 2020, [http://www.xinhuanet.com/english/2020-10/07/c\\_139424514.htm](http://www.xinhuanet.com/english/2020-10/07/c_139424514.htm).

<sup>58</sup> Kennedy, "Civil Transport in PLA Power Projection," 15-17.

<sup>59</sup> Planet Labs SkySat, Image ID: 20200811\_053052\_ssc8\_u0001, August 11, 2020, Lanshan, China, 35.156N, 119.402E, SkyWatch EarthCache, <https://www.skywatch.com>.



Figure 22. WISH WAY Semi-submersible Vessel at Anchor in Lanshan, China (© 2021 Planet Labs)<sup>60</sup>

The RO-RO Ferry HAI YANG DAO (Figure 23) arrived shortly after the WISH WAY and ZHONG HUA FU XING on 1 August 2020 and proceeded to dock with the SAN HANG GONG 8.<sup>61</sup> Commercial satellite imagery shows that the floating piers were not present and the SAN HANG GONG 8 sat alone offshore. What appear to be vehicles were located on its deck, probably to be loaded on the HAI YANG DAO, which was arriving directly from its ferry route on the Bohai Gulf. The deck barge seen in Figure 24 was en route to dock with the ZHONG HUA FU XING, which was anchored to the east, just out of frame of the image.<sup>62</sup>



Figure 23. RO-RO Ferry HAI YANG DAO (COSCO)

<sup>60</sup> Includes content sourced via SkyWatch Space Applications Inc. Inset photo: MaritimeTraffic.com

<sup>61</sup> AIS position data, HAI YANG DAO (MMSI 412468000), August 1, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>62</sup> Planet Labs SkySat, Image ID: 20200801\_053655\_ssc10\_u0001, August 1, 2020, Lanshan, China, 35.147N, 119.395E, SkyWatch EarthCache, <https://www.skywatch.com>. AIS position data, ZHONG HUA FU XING (MMSI 412283000), August 1, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).





Figure 24. Offshore Loading Activity in Lanshan Beach Harbor (© 2021 Planet Labs)<sup>63</sup>

Following the 1 August loading event in Lanshan all that remained for Exercise EASTERN TRANSPORTATION-PROJECTION 2020A was a single, large-scale evolution. The final event was first rehearsed in two parts.

2-3 August: A group of four ships, three RO-RO ferries and a cargo ship, rehearsed their part of the final training event. Weather throughout the exercise and specifically for the final training events appeared to be unremarkable.<sup>64</sup> Figure 25 and Figure 26 show the roles of ships involved in this first rehearsal.<sup>65</sup> Graphics categorize ships according to whether they performed beach landing operations, offshore offloading, or in-port offloading in Lanshan. For docking operations, the dotted line indicates the time in the harbor, the solid block indicates the time actually docked with the semi-submersible barge and floating pier.

<sup>63</sup> Includes content sourced via SkyWatch Space Applications Inc., © 2021 Planet Labs.

<sup>64</sup> Additional research is required on matters of meteorology as archived weather forecasts or actual weather conditions for the Chinese coast were not found. Some information on wind conditions were available through AIS data, which seemed to indicate that winds were light during exercise events.

<sup>65</sup> AIS position data, HAI YANG DAO (MMSI 412468000), SHENG SHENG 1 (MMSI 412328670), ZHONG HUA FU XING (MMSI 412283000), and SHENG TAI (MMSI 412081630), August 1-3, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

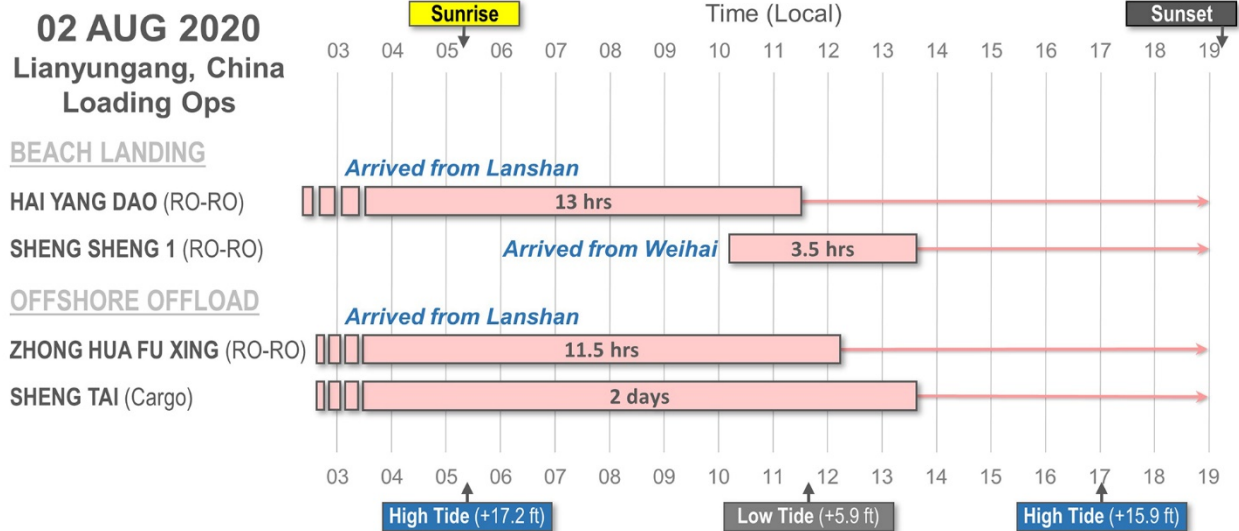


Figure 25. Loading Operations Timeline, Lianyungang, 2 August 2020

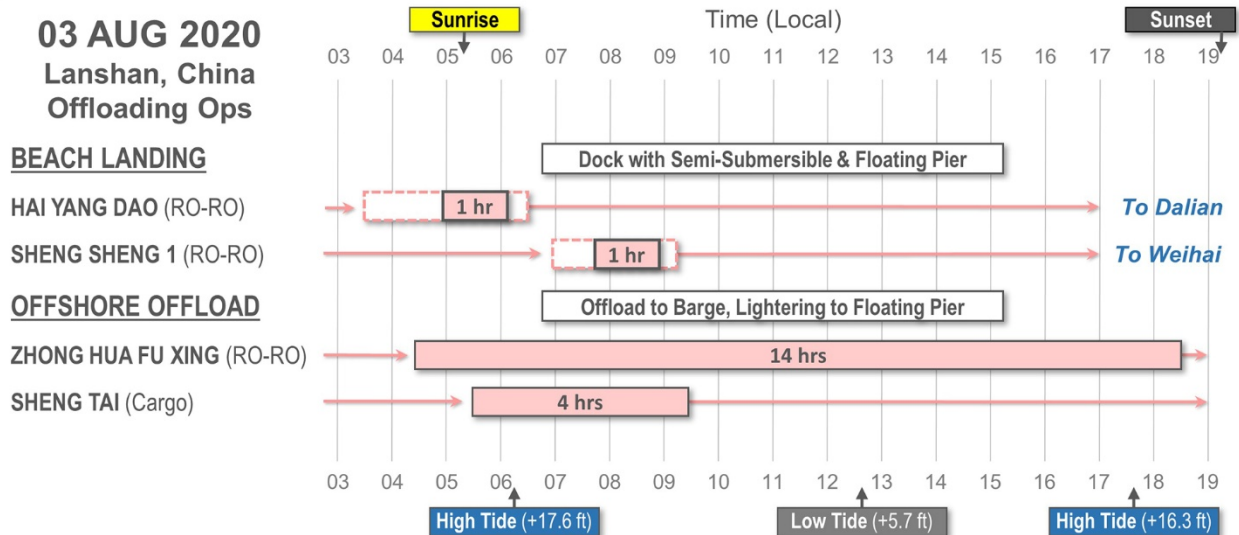


Figure 26. Unloading Operations Timeline, Lanshan, 3 August 2020

9-10 August: A week after the first rehearsal, a different set of RO-RO ferries executed their part of the final event. Figure 27 and Figure 28 show the roles of ships involved in this second rehearsal.<sup>66</sup> The general cargo ship SHENG TAI, the same class of ship as the TIAN ZHU SHAN, acted as the cargo ship for both rehearsals. The TIAN ZHU SHAN only joined the group for the final training event.

<sup>66</sup> AIS position data, BO HAI YIN ZHU (MMSI 412328370), BO HAI BAO ZHU (MMSI 412330020), BANG CHUI DAO (MMSI 412450000), and SHENG TAI (MMSI 412081630), August 8-10, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

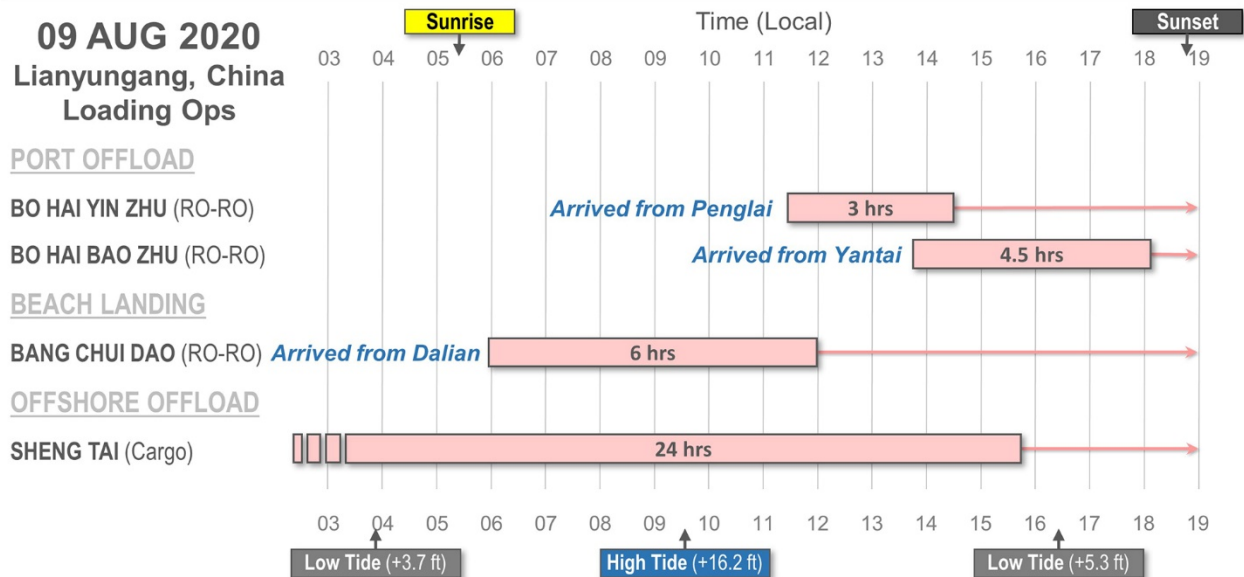


Figure 27. Loading Operations Timeline, Lianyungang, 9 August 2020

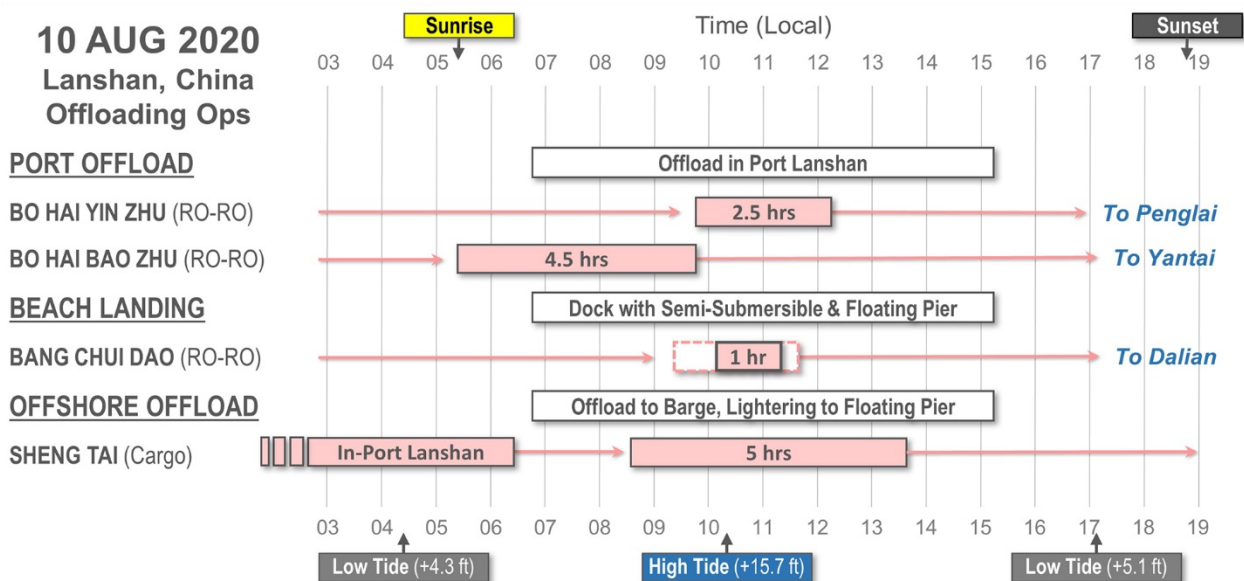


Figure 28. Unloading Operations Timeline, Lanshan, 10 August 2020

18-20 August: All eight ships conducted their respective operations together in the final training event. In this culminating exercise event, the structure and pace of training appeared to reflect a real-world operations tempo, but still extremely conservative and deliberate. In the final rehearsal and the final exercise event, RO-RO ships deployed directly from their homeports to load in Lianyungang. As mentioned previously, exercise participants loaded on one day, departed Lianyungang before nightfall, and remained overnight at an anchorage. The ships then proceeded to Lanshan the following morning to arrive around high tide. Following the final offload events, the ships immediately returned to their homeports on the Bohai Gulf.

The floating piers were disassembled in advance of the final exercise event from 18-19 August. On 17 August, the semi-submersible barge, SAN HANG GONG 8, withdrew a couple of nautical miles

offshore. Curiously, the WISH WAY also left the inner harbor on 17 August and stayed overnight at an anchorage before returning to the same spot in the Lanshan beach harbor the next morning. Again, the WISH WAY's withdrawal and return to coincide with the final training event seems to indicate that it likely had some role in the exercise. The other unique element in this final training event involved the HAI YANG DAO arriving in the harbor to dock with the SAN HANG GONG 8 at approximately 03:00 local time 19 August, the only nighttime evolution observed during this exercise. Figure 29 and Figure 30 show the roles of ships involved in the final exercise event.<sup>67</sup>

The general cargo ship TIAN ZHU SHAN arrived in the Lanshan beach exercise area late in the day on 19 August. It replaced the cargo ship SHENG TAI at the floating crane in the middle of the harbor. No LCU activity was noted after the TIAN ZHU SHAN's arrival to indicate offloading activity. TIAN ZHU SHAN remained moored at the crane until the next morning when offloading operations with the LCUs recommenced. The cargo ship departed the harbor at approximately 1300 local time on 20 August, apparently bringing the exercise to a close.<sup>68</sup>

The WISH WAY departed its anchorage at 1800, just five hours after the final offload event. The reason for the presence of the semi-submersible ship and its activities during the exercise remains unknown. This semi-submersible ship would be an excellent means to transport and deploy the floating pier system to its operating area, but there are no indications that occurred. Following the exercise, the WISH WAY proceeded to Qingdao, a major commercial port and home to the PLAN's North Sea Fleet.<sup>69</sup> The ship may have gone to Qingdao to offload exercise equipment, but again, not the floating pier. That system remained in Lanshan until at least November 2020. The SAN HANG GONG 8 semi-submersible barge departed on 27 August and returned to port construction projects in southern Fujian province, directly across the strait from Taiwan.<sup>70</sup>

### *Exercise Re-deployment*

The 33,000-ton RO-RO ferry BO HAI MA ZHU, which had not been involved in any other exercise evolutions, arrived in Lanshan on 23 August 2020, probably to collect exercise participants and their equipment. Two days later, the ship called in Jiangyin Town, Fujian where the deployment to Lianyungang had originated two months earlier.<sup>71</sup>

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<sup>67</sup> AIS position data, HAI YANG DAO (MMSI 412468000), SHENG SHENG 1 (MMSI 412328670), ZHONG HUA FU XING (MMSI 412283000), SHENG TAI (MMSI 412081630), BO HAI YIN ZHU (MMSI 412328370), BO HAI BAO ZHU (MMSI 412330020), BANG CHUI DAO (MMSI 412450000), and TIAN ZHU SHAN (MMSI 412076010), August 18-20, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>68</sup> AIS position data, TIAN ZHU SHAN (MMSI 412076010) and SHENG TAI (MMSI 412081630), August 18-20, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>69</sup> AIS position data, WISH WAY (MMSI 371578000), August 20-27, 2020, [www.marinetraffic.com](http://www.marinetraffic.com). WISH WAY was in Qingdao harbor from August 24-26, 2020 for unknown reasons, but did not appear to go pierside.

<sup>70</sup> AIS position data, SANHANGGONG8 (MMSI 413378280) and SAN HANG TUO 4007 (MMSI 412704260), August 20-28, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>71</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000), August 23-25, 2020, [www.marinetraffic.com](http://www.marinetraffic.com).



**18 AUG 2020**  
**Lianyungang, China**  
**Loading Ops**

PORT OFFLOAD

BO HAI YIN ZHU (RO-RO)

BO HAI BAO ZHU (RO-RO)

BEACH LANDING

HAI YANG DAO (RO-RO)

SHENG SHENG 1 (RO-RO)

BANG CHUI DAO (RO-RO)

OFFSHORE OFFLOAD

ZHONG HUA FU XING (RO-RO)

SHENG TAI (Cargo)

TIAN ZHU SHAN (Cargo)

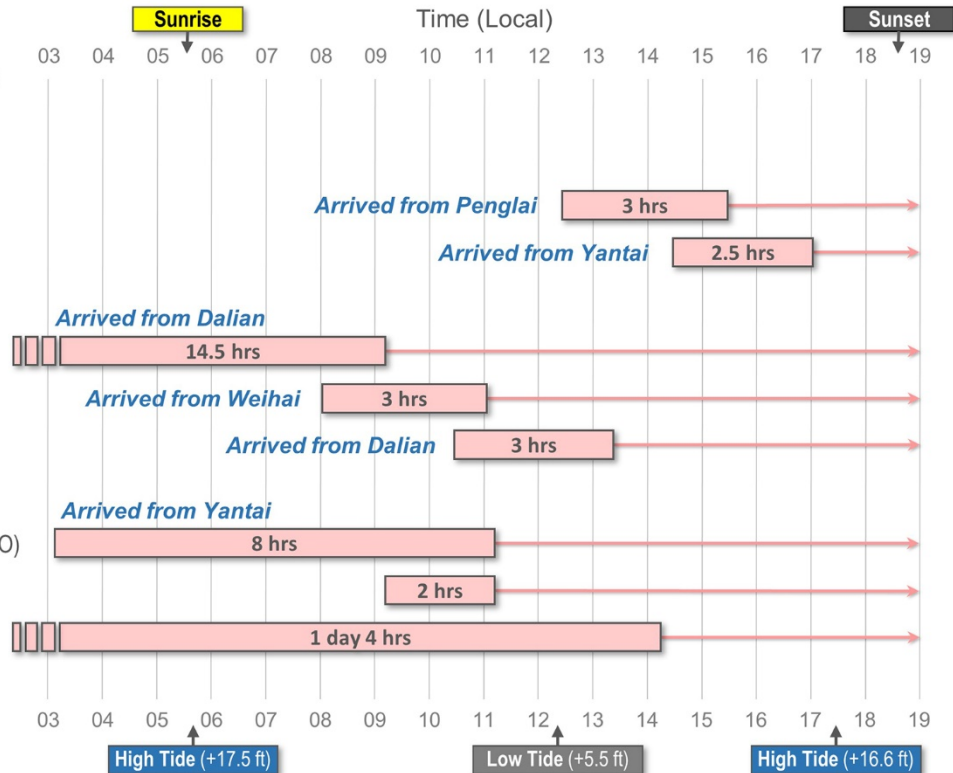


Figure 29. Loading Operations Timeline, Lianyungang, 18 August 2020

**19 AUG 2020**  
**Lanshan, China**  
**Offloading Ops**

PORT OFFLOAD

BO HAI YIN ZHU (RO-RO)

BO HAI BAO ZHU (RO-RO)

BEACH LANDING

HAI YANG DAO (RO-RO)

SHENG SHENG 1 (RO-RO)

BANG CHUI DAO (RO-RO)

OFFSHORE OFFLOAD

ZHONG HUA FU XING (RO-RO)

SHENG TAI (Cargo)

TIAN ZHU SHAN (Cargo)

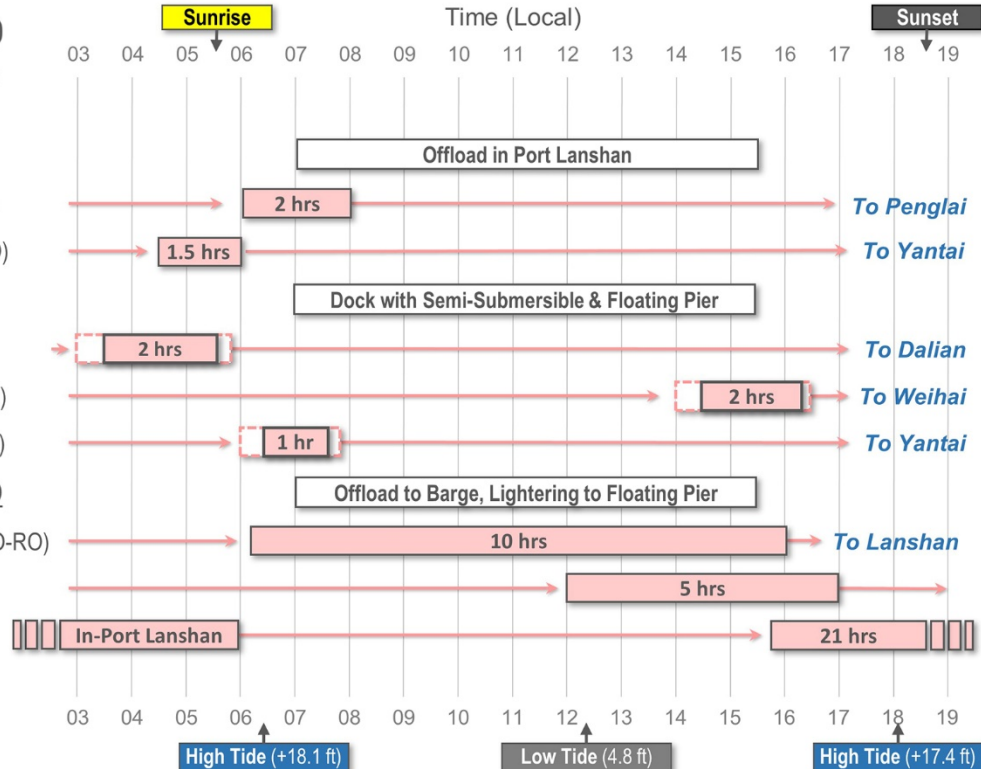


Figure 30. Unloading Operations Timeline, Lanshan, 19 August 2020

## **2020 JLSF Exercise Analysis**

EASTERN TRANSPORTATION-PROJECTION 2020A was a military-civil training event that exercised amphibious over-the-shore logistics capabilities. The June-August 2020 exercise involved over sixteen civilian ships, a variety of amphibious logistics equipment, and a handful of PLAN landing craft. Eight large civilian RO-RO ferries played a significant role, offloading vehicles directly onto a beach landing area via a floating pier, materiel offshore onto a floating platform for transfer to the beach, and vehicles and equipment into an austere port facility. Two general cargo ships also offloaded cargo offshore using a floating crane before LCUs transferred the materiel to shore.

The exercise reviewed here, set off of a relatively small beach in a protected harbor, appears to demonstrate limited, and in some cases, novel capabilities. It did not demonstrate the capacity to support a major maritime lift as part of a cross-strait invasion. With one exception, all civil-maritime exercise operations were conducted during daylight hours; events were timed for when tides and weather conditions were favorable. Most evolutions took place in the sheltered waters of an inner harbor that is not representative of likely real-world environments in which these capabilities would be operationalized. That said, the likely overarching objective of the exercise was to test equipment and procedures. In that regard, the exercise almost certainly met its goals and was probably regarded as a success by the JLSF.

Other than a handful of utility landing craft and the armor elements that were transported by civilian ships, PLA combat forces did not participate in EASTERN TRANSPORTATION-PROJECTION 2020A. Any coordination by and with the PLAN was not evident. Admittedly, having a PLAN combatant on stand-by to escort civilian ships through busy waterways filled with other Chinese ships that were oblivious to the exercise was likely deemed unnecessary. Similarly, it would have been difficult to justify having an entire amphibious infantry brigade sitting around a port for a month waiting to be transported from “A” to “B” while the JLSF worked through checklists and procedures with civilian exercise participants.

## 2021 Military-Civil Fusion Amphibious & Logistics Exercise Activity

There are no indications that the PLA conducted a large-scale over-the-beach logistics exercise in 2021 similar to EASTERN TRANSPORTATION-PROJECTION 2020A. However, between July and September 2021, seven of the vessels that had participated in the 2020 exercise participated in direct beach assault operations and experimented with new amphibious logistics technologies. In total, fourteen civilian vessels, including eight civilian RO-RO ferries, participated in military exercise activity during summer 2021. The 2021 MCF exercise event timeline is shown in Table 3.

Table 3. Timeline of 2021 Military-Civil Fusion Amphibious and Logistics Exercise Activity

Activity	Dates (2021)	Major Events
Unit-Level Training/Exercises—Southern Theater Command	22 July–11 August	Two RO-RO ferries conducted apparent amphibious assault training with PLA marine or amphibious infantry units and participated in at least two military exercises.
Large Exercise—Eastern Theater Command	02-08 September	At least eight civilian vessels participated in what was probably a large, multi-faceted PLA exercise.
Logistics Operations	02-08 September	Four RO-RO ferries and two general cargo ships conducted coordinated operations in four civilian ports in eastern China known to be used by the PLA in a likely large intra-theater mobility exercise.
Amphibious Assault Operations	02-04 September	Two RO-RO ferries conducted off-shore operations deploying PLA assault boats and armor, probably with PLAN amphibious assault ships.
Floating Causeway Test and Evaluation	11-25 September	Two RO-RO ferries conducted test and evaluation with the PLA's new floating causeway system.

### *Unit-Level Training/Exercises—Southern Theater Command*

Two RO-RO ferries were observed conducting amphibious landing training in the PLA's Southern Theater from 22 July to 11 August 2021. This activity involved the RO-RO ferries operating offshore over several days, probably deploying and recovering amphibious assault boats and possibly amphibious armor. Exercising RO-RO ferries as auxiliary amphibious landing ships to deploy PLA combat units offshore represents a significant evolution in the combat support role of these civilian ships in PLA operations. Civilian vessels participating in July-August 2021 amphibious exercises appear in Table 4.

Table 4. RO-RO Ferries Participating in Amphibious Landing Training, July-August 2021<sup>72</sup>

Ex. 2020A	Ship Name	Length / Gross Tonnage	Owner
Yes	BO HAI MA ZHU	590 ft / 33,400 t	Shandong Bohai Ferry Co. (Bohai Ferry)
No	HU LU DAO	443 ft / 15,500 t	China Shipping Pass. Liner Co. (COSCO)

<sup>72</sup> The column "Ex. 2020A" indicates whether the ship participated in Exercise EASTERN TRANSPORTATION-PROJECTION 2020A.

On 12 July 2021, the civilian RO-RO ferry BO HAI MA ZHU collected a PLAN Marine Corps armored infantry unit from a civilian quay adjacent to the PLAN base in Qingdao, China.<sup>73</sup> The ship then returned to its ferry terminal in Dalian. The Marine Corps unit may have disembarked in Dalian for training in the Northern Theater. Alternatively, the unit may have been split between the BO HAI MA ZHU and HU LU DAO to proceed for training in the Southern Theater. According to their AIS tracks, both RO-RO ferries departed Dalian on 13 July en route to southern China. They arrived off of Qianhai (Yangjiang), Guangdong province on 17 July 2021 (Figure 31). Commercial satellite imagery indicates that PLAN tank landing ships (LSTs) probably conducted amphibious landing operations at Qianhai Beach just prior to the ferries' arrival.<sup>74</sup>

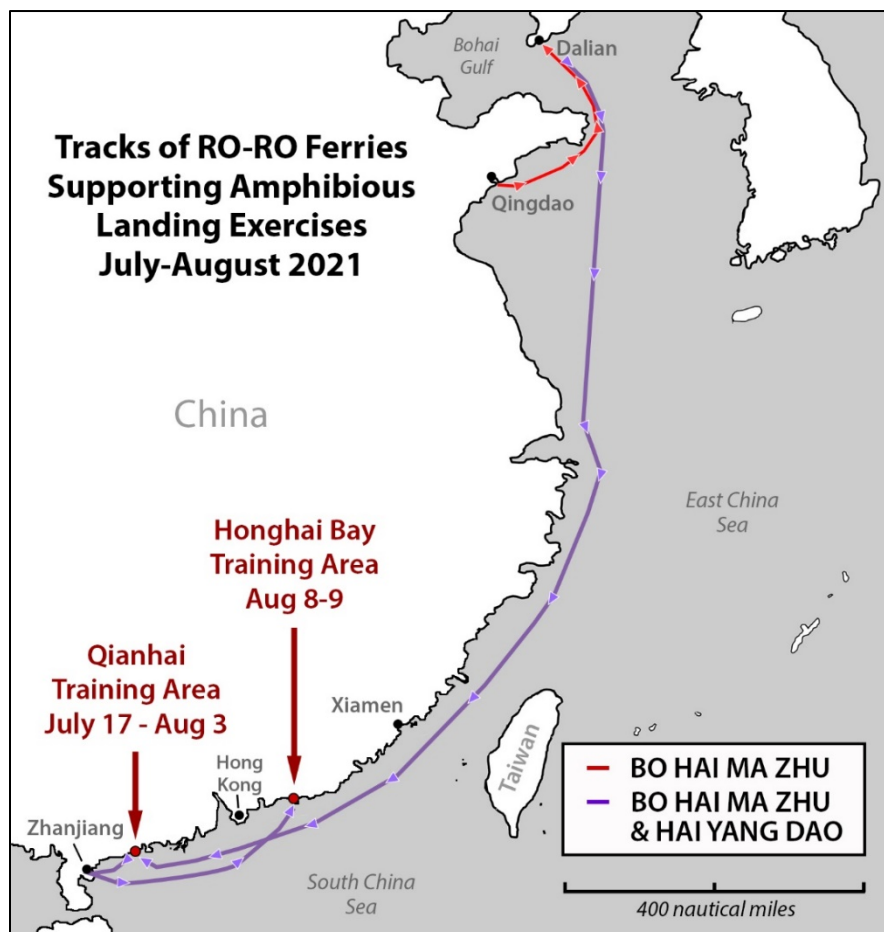


Figure 31. Tracks of RO-RO Ferries Supporting Amphibious Landing Exercises, July-August 2021

The BO HAI MA ZHU and HU LU DAO remained in the vicinity of Qianhai Beach for eighteen days, usually between two and four nautical miles offshore. Twice, each ship made a short call in the nearby ports of Maoming and Shuidong, probably either to offload or on-load equipment, refuel, or

<sup>73</sup> 海军陆战队某旅组织联合跨海投送演练 [“Marine Corps Brigade Organized Joint Cross-Sea Projection Exercise”], 中国军视网 [China Military Television Network], July 22, 2021, [http://www.js7tv.cn/video/202107\\_253134.html](http://www.js7tv.cn/video/202107_253134.html).

<sup>74</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and HU LU DAO (MMSI 413134000), July 11-August 11, 2021, [www.marinetraffic.com](http://www.marinetraffic.com). Planet Labs PlanetScope, Image ID: 20210717\_024745\_1035, July 17, 2021, Qianhai (aka Fuhu Harbor 福湖港), China, 21.492N, 111.527E, [www.planet.com](http://www.planet.com).



resupply.<sup>75</sup> Throughout this time, these RO-RO ferries probably deployed and recovered PLA assault boats (冲锋舟). These high-speed, ten-person, steel-hull craft equipped with outboard motors are used by the PLA to rapidly deploy infantry in amphibious landing areas. 120 such boats—enough to land over 1000 infantry troops ashore—were seen in high-resolution satellite imagery off Qianhai Beach on 23 July 2021 (Figure 32).<sup>76</sup> Other than this image, the boats were missing from other available high-resolution satellite images. They may have been stored under what appear to be canopies immediately to the east of where the boats were imaged.

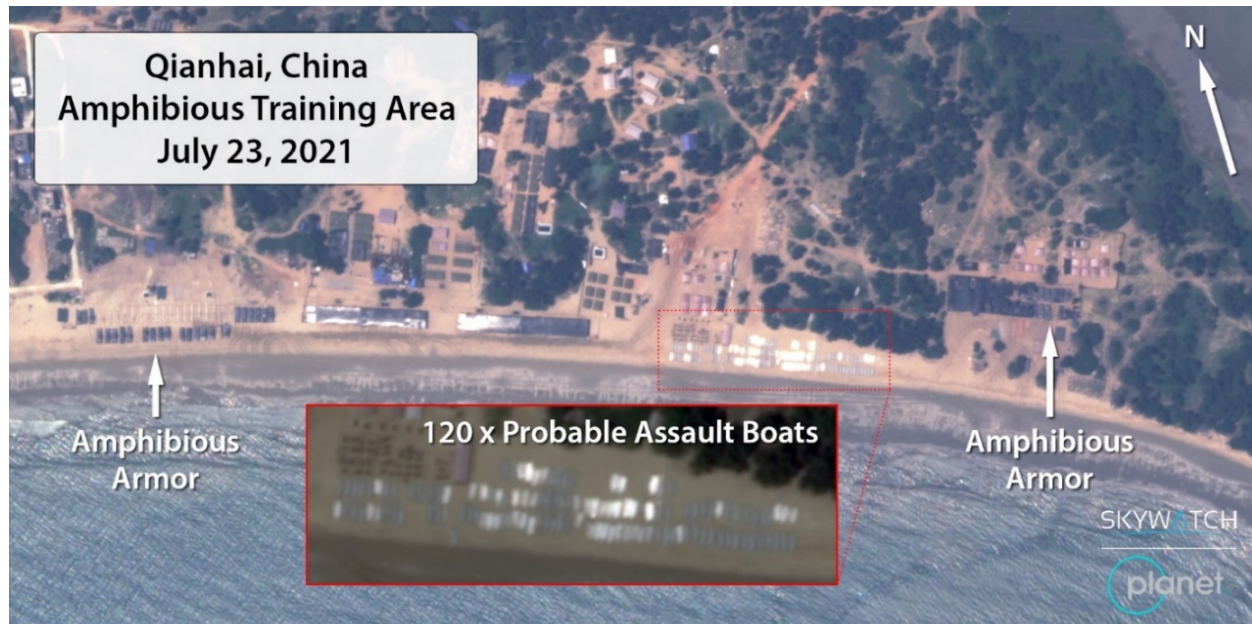


Figure 32. 120 Probable Assault Boats on Qianhai Beach (© 2021 Planet Labs)<sup>77</sup>

A 26 July 2021 medium-resolution satellite image shows what are probably assault boats and amphibious armor operating miles off of Qianhai Beach (Figure 33).<sup>78</sup> Over ninety wakes appear in the image, indicating that these were probably made by a mix of the small assault boats and the limited numbers of larger amphibious armored vehicles noted at Qianhai Beach. Dozens of the wakes were heading toward the two ferries, indicating the possible on-loading of boats or vehicles. Other wakes, northeast of the where the ferries were on-loading, appear to be headed into the amphibious training area. The boats or vehicles follow in each other's wake as opposed to assuming a line-abreast formation. Many amphibious exercise areas in China as well as beach landing sites in northern Taiwan are relatively narrow. The beach front constraint lends itself to “follow the leader” beach landing tactics that allow large numbers of forces to land in a relatively small area.

<sup>75</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and HU LU DAO (MMSI 413134000), July 17-August 3, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>76</sup> Planet Labs SkySat, Image ID: 20210723\_055645\_ssc9\_u0001, July 23, 2021, Qianhai (aka Fuhu Harbor 福湖港), China, 21.523N, 111.535, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>77</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>78</sup> Planet Labs PlanetScope, Image ID: 20210726\_021919\_86\_245a, July 26, 2021, Qianhai (aka Fuhu Harbor 福湖港), China, 21.495N, 111.524E, [www.planet.com](http://www.planet.com).

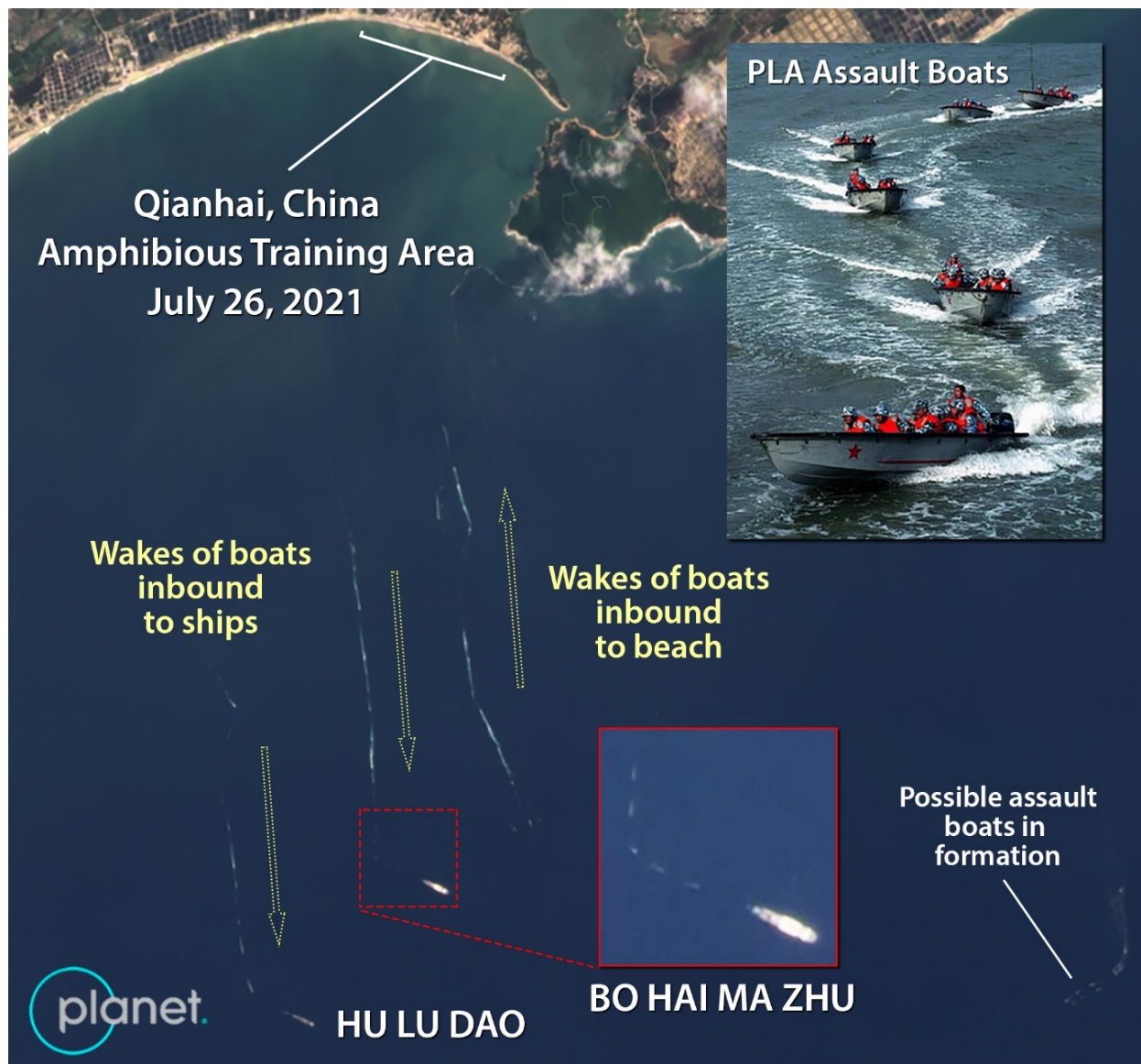


Figure 33. Probable Assault Boats Exercising with Civilian RO-RO Ferries (© 2021 Planet Labs)

There is evidence that the BO HAI MA ZHU and HU LU DAO may have deployed and recovered amphibious armor offshore. In 2020, Chinese media reports revealed that the RO-RO ferry BANG CHUI DAO, the same class of ship as the HU LU DAO, had been modified with a reinforced ramp for deploying amphibious armored vehicles at sea.<sup>79</sup> On 26 July 2021, high-resolution satellite imagery taken thirty-six minutes after the medium-resolution image above shows both RO-RO ferries offshore with their vehicle ramps down. Three rectangular objects, possibly amphibious armor, are inbound to the BO HAI MA ZHU. At the same moment, half-a-dozen amphibious vehicles were imaged landing at Qianhai Beach (Figure 34).<sup>80</sup>

<sup>79</sup> Conor Kennedy, "Ramping the Strait: Quick and Dirty Solutions to Boost Amphibious Lift," *China Brief*, 21 no. 14 (July 16, 2021), <https://jamestown.org/program/ramping-the-strait-quick-and-dirty-solutions-to-boost-amphibious-lift/>.

<sup>80</sup> Planet Labs SkySat, Image ID: 20210726\_025513\_ssc12\_u0001, July 26, 2021, Qianhai (aka Fuhu Harbor 福湖港), China, 21.521N, 111.536E and 21.463N, 111.528E, [www.planet.com](http://www.planet.com).



Given the limits of available imagery, it is possible that the rectangular objects that appear to be loading onto the ferries are in fact small boats and not amphibious armor. PLA amphibious armored vehicles have been noted doing “out-and-back” training from beaches without deploying from a landing ship. This report could not determine whether these ferries’ ramps were built or reinforced to accommodate the weight of armored vehicles entering or exiting offshore waters.

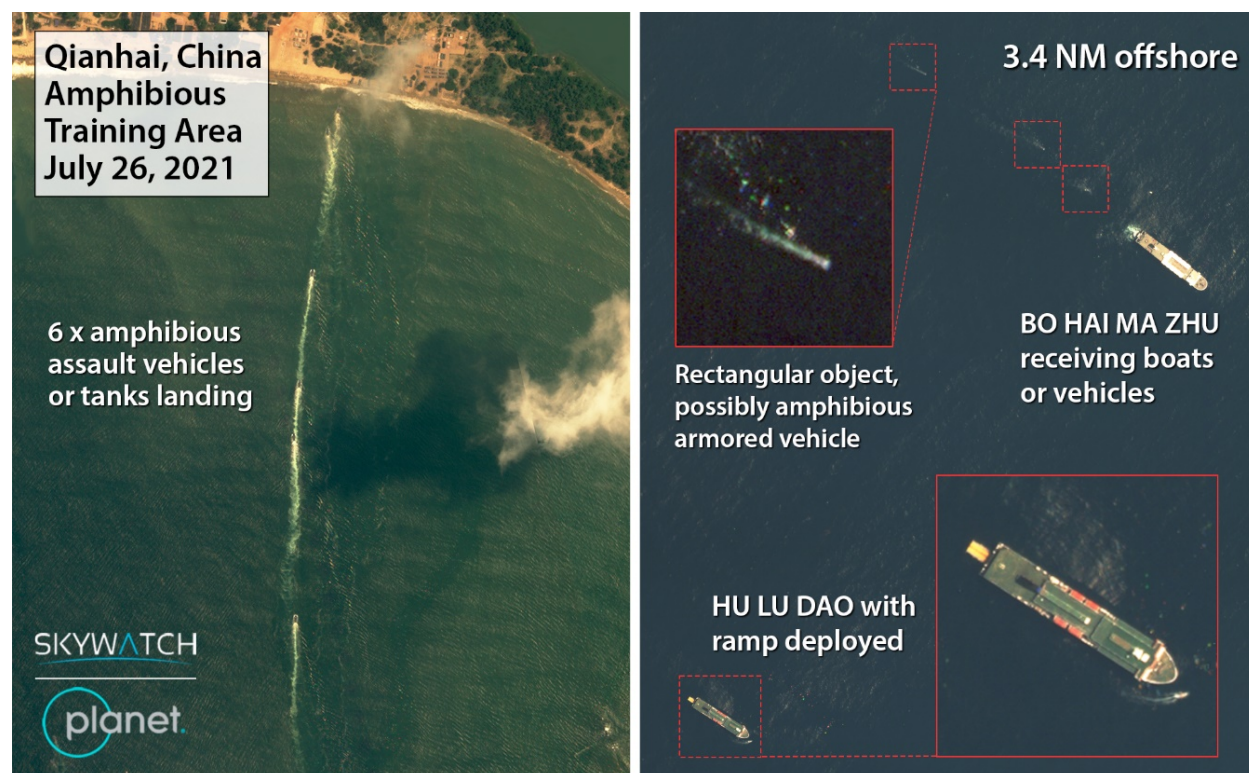


Figure 34. Landing Operations Concurrent with RO-RO Ferry Possibly Recovering Amphibious Vehicles (© 2021 Planet Labs)<sup>81</sup>

The dual-ferry operations with assault boats and amphibious armored vehicles likely culminated in an exercise involving PLAN ships and possibly other military elements in the waters off of Qianhai Beach. The Yangjiang Maritime Safety Administration (MSA) issued a closure area for a military exercise from 31 July to 03 August 2021 that included the Qianhai Beach operating area.<sup>82</sup> During that time, the BO HAI MA ZHU and the HU LU DAO operated in the closure area between a nearby anchorage and the Qianhai beach landing area, probably deploying and recovering amphibious elements as part of the exercise.<sup>83</sup>

Following the exercise at Qianhai, the two ferries transited to the PLAN South Sea Fleet naval base at Zhanjiang, arriving on 4 August 2021. The BO HAI MA ZHU and the HU LU DAO probably loaded military equipment overnight and departed the next morning. The ships proceeded to Honghai Bay, 69 nautical miles east of Hong Kong, to participate in a two-day amphibious landing evolution

<sup>81</sup> Includes content sourced via SkyWatch Space Applications Inc., © 2021 Planet Labs.

<sup>82</sup> 粤阳航通 [2021] 0071 号 [Guangdong Navigation Notice 2021, No. 0071], 中华人民共和国阳江海事局航行通告, [PRC Yangjiang Maritime Safety Administration], July 31, 2021, <https://www.msa.gov.cn/html/hxaq/aqxx/hxtg/gdhsj/20210731/631E7C79-A8E7-4E36-AAEE-14A07096B3F5.html>.

<sup>83</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and HU LU DAO (MMSI 413134000), July 31-August 3, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

(8-9 August).<sup>84</sup> The Guangdong MSA issued a large closure area for a military exercise from 5-12 August that encompassed Honghai Bay.<sup>85</sup>

Medium-resolution satellite imagery on 8 August shows BO HAI MA ZHU and ships that measure approximately 390 feet (120 meters)—the same length as PLAN Type-072 LSTs—departing what had probably been their offload area at high speed. The BO HAI MA ZHU had stopped four nautical miles offshore for 90 minutes, probably to deploy assault boats and/or amphibious armor (Figure 35). Wakes of probable amphibious armor and assault boats can be seen in the image. Concurrent with this activity, the HU LU DAO was apparently conducting similar offloading operations to the east. The HU LU DAO was stationary for approximately 30 minutes three nautical miles offshore, outside the frame of the available satellite image.<sup>86</sup>

After their likely at-sea offload operations, the ships withdrew several miles offshore at approximately 12 knots, relatively high-speed for these RO-RO ferries.<sup>87</sup> This maneuver likely simulated a tactical withdrawal following offloading to mitigate any threats to the civilian ferries from adversary forces onshore. The withdrawal tactics observed at Honghai Bay indicate the RO-RO ferries were likely exercised in a direct combat support role with enemy threats in mind vice the unopposed logistics support activity that had been observed in the 2020 JLSF exercise.

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<sup>84</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and HU LU DAO (MMSI 413134000), August 4-9, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>85</sup> 粤航警 174/21 [Guangdong Navigation Warning 174/21], 广东海事局 [Guangdong Maritime Security Administration], August 5, 2021, <https://www.msa.gov.cn/html/hxaq/aqxx/hxjg/Guangdong/20210805/C7F1EF82-32F9-4840-9A4F-5E02E1264798.html>.

<sup>86</sup> Planet Labs PlanetScope, Image ID: 20210808\_020445\_25\_2439, August 8, 2021, Honghai Bay, China, 22.652N, 115.392E, [www.planet.com](http://www.planet.com). AIS position data, BO HAI MA ZHU (MMSI 414211000) and HU LU DAO (MMSI 413134000), August 8, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>87</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and HU LU DAO (MMSI 413134000), August 8, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).



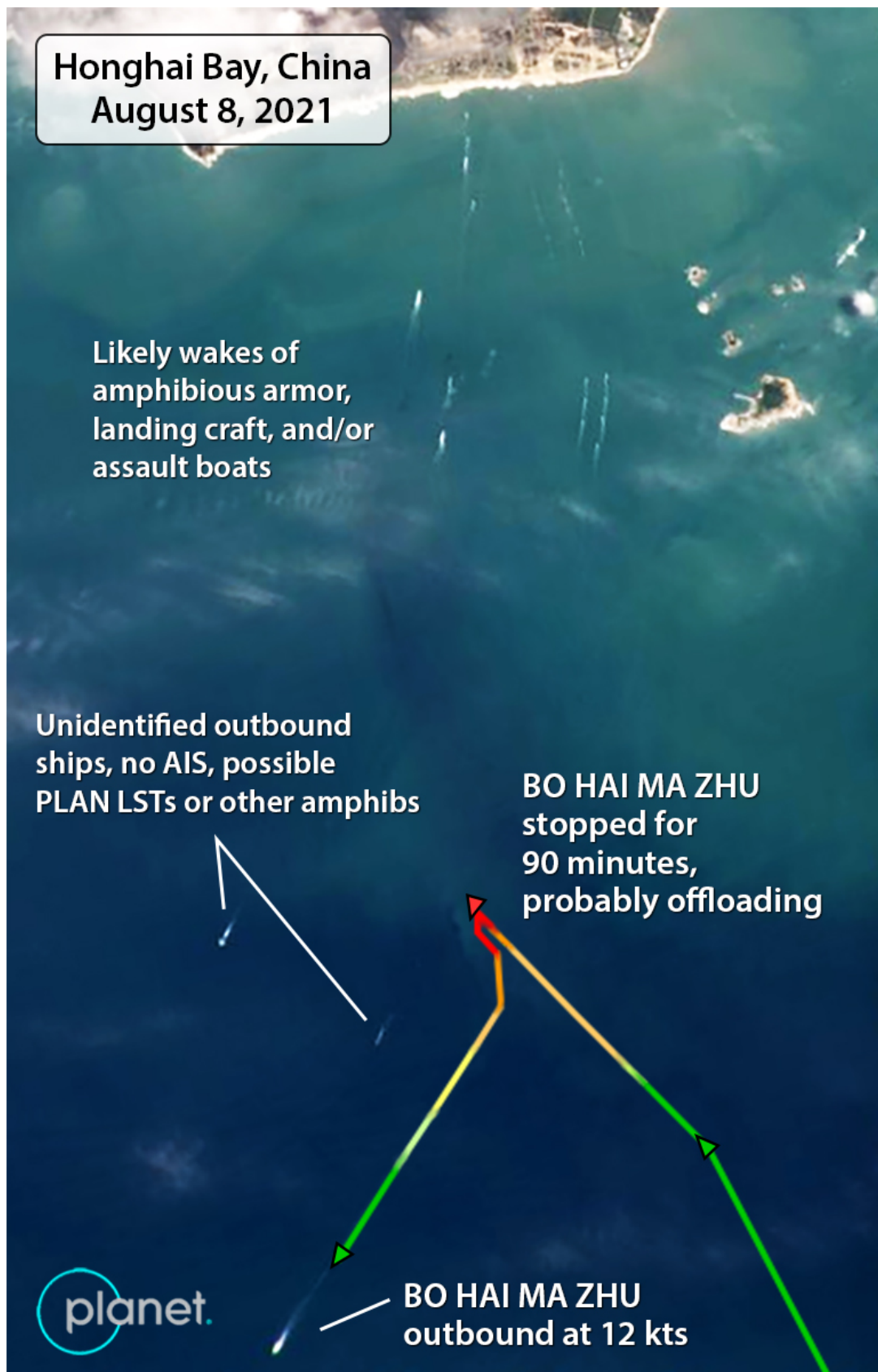


Figure 35. BO HAI MA ZHU Withdrawal from Honghai Bay Likely After Offloading (© 2021 Planet Labs)

AIS tracks on 8 August indicate that after several hours, both RO-RO ferries moved back within a few miles of the shore landing site, possibly to on-load troops and equipment that had been deployed hours earlier. Late on 8 August, the HU LU DAO started its return journey to the Zhanjiang naval base. The BO HAI MA ZHU remained in Honghai Bay. On 9 August, it executed the same offshore maneuvers indicating another amphibious landing evolution. The BO HAI MA ZHU then also returned to Zhanjiang naval base, probably to offload the military equipment with which it had been exercising. Following their offload in Zhanjiang, both ships began the 1,500 nautical mile trek back to their ferry routes across the Bohai Gulf.<sup>88</sup>

#### *Large Exercise—Eastern Theater Command*

In September 2021, at least seven RO-RO ferries and two general cargo ships participated in what was likely a large-scale PLA exercise. Notable activities included a large-scale mobility evolution that was synchronized with other RO-RO ferries supporting amphibious beach landings. Test and evaluation with the new-type floating causeway (discussed below) occurred following the operational phase of the exercise. This September military-civil fusion training was likely the capstone event for civilian shipping integration in summer 2021 PLA exercises.

The exercise spanned the length of the coastline in the Eastern Theater Command's area of responsibility. Civilian ship exercise activity stretched from Dacheng Bay, which sits on the border with the Southern Theater Command, to the port of Lianyungang, 670 nautical miles north and only a few miles from the border with the Northern Theater Command. Lianyungang was also the embarkation port for the 2020 JLSF exercise. Figure 36 shows the tracks of the RO-RO ferries and cargo ships that supported PLA exercises in September 2021.<sup>89</sup>

Three different groups of vessels were identified in the early-September PLA exercise—a RO-RO logistics group consisting of four large RO-RO ferries, a cargo logistics group consisting of two general cargo ships, and a RO-RO ferry landing group consisting of two RO-RO ferries that conducted amphibious landing operations. Half of the merchant ships identified in these groups participated in the 2020 JLSF logistics exercise. Additionally, a probable test and evaluation group of two RO-RO ferries practiced docking with a new floating causeway system in late-September.

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<sup>88</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and HU LU DAO (MMSI 413134000), August 8-16, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>89</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000), BO HAI CUI ZHU (MMSI 414096000), BANG CHUI DAO (MMSI 412450000), ZHONG HUA FU XING (MMSI 412283000), BO HAI ZHEN ZHU (MMSI 413409000), BO HAI ZUAN ZHU (MMSI 414210000), DA FENG GANG LI MING HAO (MMSI 413239310), SHENG TAI (MMSI 412081630), and TIAN ZHU SHAN (MMSI 412076010), August 31-September 10, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

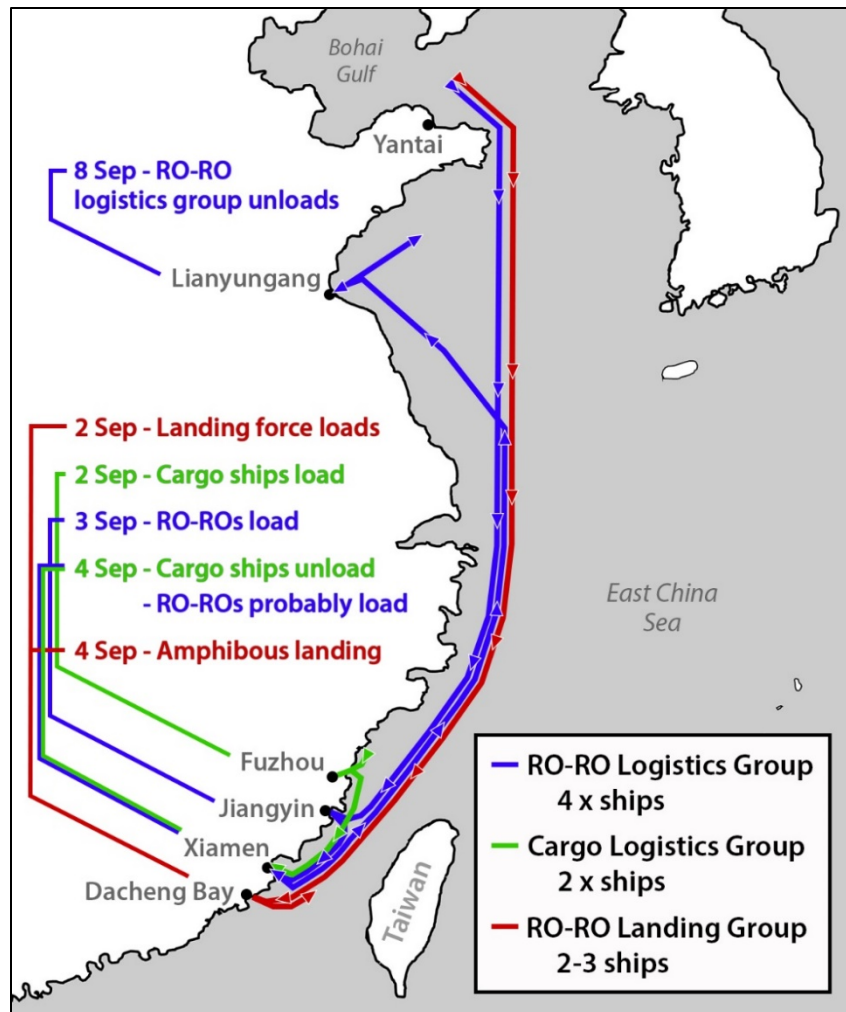


Figure 36. Tracks of Civilian Ships Supporting PLA Exercises, September 2021

#### RO-RO and General Cargo Logistics Operations

From 31 August through 8 September 2021, four RO-RO ferries and two general cargo ships conducted an Eastern Theater intra-theater mobility exercise, what the PLA call a “cross-sea projection” (跨海投送) exercise. Information on logistics group ships appears in Table 5.

Three large RO-RO ferries from the Bohai Ferry Group departed their routine routes on 31 August and proceeded to the Taiwan Strait. A fourth RO-RO ship that had not previously been observed supporting the PLA joined the three ferries in the East China Sea on their southward trek.<sup>90</sup> On 3 September 2021, all four ships arrived in Jiangyin, the port from where JLSF elements had likely deployed for Exercise EASTERN TRANSPORTATION-PROJECTION 2020A. Here, the RO-RO ships may have again picked up JLSF staff, depot personnel, and equipment to facilitate logistics training during the exercise. All four RO-RO ships departed Jiangyin on the morning of 3 September.

<sup>90</sup> AIS position data, ZHONG HUA FU XING (MMSI 412283000), BO HAI ZHEN ZHU (MMSI 413409000), BO HAI ZUAN ZHU (MMSI 414210000), and DA FENG GANG LI MING HAO (MMSI 413239310, August 31-September 3, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).



Table 5. Merchant Ships Participating in Logistics Training, September 2021

Ex. 2020A	Ship Name	Type	Length / Gross Tonnage	Owner
Yes	ZHONG HUA FU XING	RO-RO	696 ft / 45,000 t	Weihai Haida Passenger Transportation Co. (Bohai Ferry)
Yes	BO HAI ZHEN ZHU	RO-RO	538 ft / 24,000 t	Shandong Bohai Ferry Co. (Bohai Ferry)
No	BO HAI ZUAN ZHU	RO-RO	590 ft / 33,400 t	Shandong Bohai Ferry Co. (Bohai Ferry)
No	DA FENG GANG LI MING HAO	RO-RO	538 ft / 34,000 t	Weihai Sheng'an Marine Shipping Co.
Yes	SHENG TAI	Gen Cargo	323 ft / 4,000 t	China COSCO Shipping Corp.
Yes	TIAN ZHU SHAN	Gen Cargo	323 ft / 4,000 t	Shanghai Changjiang Shipping (Sinotrans)

The fourth ship in the RO-RO group, the DA FENG GANG LI MING HAO, operated by Weihai Sheng'an Marine Shipping, is a large RO-RO that normally transports volumes of commercial vehicles (Figure 37). It generally does not operate on a regular ferry route.<sup>91</sup> A RO-RO ship of this type, operated by the Chinese conglomerate Sinotrans, was featured in a June 2020 Chinese media report on a cross-sea projection exercise in which the ship transported a PLA armored brigade.<sup>92</sup>



Figure 37. RO-RO Vehicles-Carrier DA FENG GANG LI MING HAO (Weihai Sheng'an Marine Shipping)

On 1-2 September 2021, two general cargo ships supporting the exercise arrived at adjacent berths in Fuzhou, China. These two ships, the SHENG TAI and TIAN ZHU SHAN, had also participated in the 2020 JLSF exercise. Both probably loaded vehicles and cargo and departed within minutes of each other on the morning of 3 September.<sup>93</sup>

<sup>91</sup> 威海市升安海运有限责任公司 [Weihai Sheng'an Shipping Co., Ltd.], “大丰港黎明号” [DA FENG GANG LI MING HAO], accessed October 15, 2021, <http://sdseafarer.com/pd.jsp?id=16>.

<sup>92</sup> 军地联合 完成重装跨海投送 [“Military-Civil Joint Forces Complete Heavy Equipment Cross-Sea Projection”], 中国军视网 [China Military Television Network], June 7, 2020, [https://www.js7tv.cn/video/202006\\_219448.html](https://www.js7tv.cn/video/202006_219448.html). The video shows CHANG DA LONG (MMSI 413473010) loading armor elements from the 74<sup>th</sup> Group Army.

<sup>93</sup> AIS position data, SHENG TAI (MMSI 412081630), and TIAN ZHU SHAN (MMSI 412076010), September 1-3, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

All four RO-RO ships arrived in port Xiamen within three hours of each other early on 04 September 2021. The two general cargo vessels arrived a few hours later and berthed adjacent to the RO-RO ships by mid-day. Satellite imagery was not available to indicate whether vehicles or equipment was offloaded from the ships. However, satellite imagery does appear to indicate that columns of military trucks and armor were probably staged for loading onto the ships in areas normally left clear for the port's container cranes (Figure 38). The BO HAI ZHEN ZHU was berthed at a ferry terminal 1.5 nautical miles south of this satellite image.<sup>94</sup>



Figure 38. RO-RO Ships in Port Xiamen, China (© 2021 Planet Labs)

It is unlikely that the large RO-RO ferries were loaded to capacity for this exercise. These classes of RO-RO ferries have multiple decks and can accommodate 300-350 vehicles which would normally include a large number of smaller automobiles.<sup>95</sup> Maximum numbers of military utility vehicles, trucks, and tracked vehicles probably range from 75-150, depending on the mix. Each ferry can also transport up to 2,000 troops for relatively short at-sea periods. The ferries likely do not have the facilities to feed and support thousands of personnel for extended voyages.

The two general cargo ships may have cross-decked cargo and equipment to the RO-ROs before they departed on 5 September 2021. The cargo ships appeared to return to normal commercial activity after departing Xiamen. The four RO-RO ships also departed Xiamen on 5 September within two hours of each other and proceeded north to Lianyungang. The ships arrived in Lianyungang within a

<sup>94</sup> Planet Labs PlanetScope, Image ID: 20210904\_015513\_39\_2428, September 4, 2021, and 20210903\_015638\_90\_2436, September 3, 2021, Xiamen, China, 24.520N, 118.080E, [www.planet.com](http://www.planet.com). AIS position data, ZHONG HUA FU XING (MMSI 412283000), BO HAI ZHEN ZHU (MMSI 413409000), BO HAI ZUAN ZHU (MMSI 414210000), DA FENG GANG LI MING HAO (MMSI 413239310), SHENG TAI (MMSI 412081630), and TIAN ZHU SHAN (MMSI 412076010), September 4, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>95</sup> See, for example, “渤海钻珠” [BO HAI ZUAN ZHU], Bohai Ferry Group, accessed October 15, 2021, <http://www.bhferry.com/zuanzhu.html>. There are six ferries in this class that carry up to 300 cars—vehicle deck lane length equals 1.35 nautical miles (2500 meters). The ZHONG HUA FU XING can carry up to 350 cars.

few hours of each other on the morning of 8 September. The RO-RO ships were only in port for between three and five hours, probably offloading equipment and vehicles. All the ships departed Lianyungang by mid-day on 8 September to return to ferry service on the Bohai Gulf.<sup>96</sup>

#### RO-RO Ferry Amphibious Landing Operations

On 30 August 2021, one day prior to the RO-RO logistics ferries getting underway from the Bohai Gulf, two other ferries from the Bohai Ferry Group deployed to the vicinity of the Taiwan Strait to participate in an amphibious landing exercise. The BO HAI MA ZHU, which had only concluded its amphibious landing training in southern China two weeks earlier, was accompanied by one of its sister-ships, the BO HAI CUI ZHU.<sup>97</sup> The BO HAI CUI ZHU had made a run to Qingdao on 20 August, just as the BO HAI MA ZHU had done in July 2021, probably to pick up troops and equipment. This force may have deployed with the ferries to the Taiwan Strait for the exercise. RO-RO ferries that may have participated in amphibious landing exercises are listed in Table 6.

Table 6. RO-RO Ferries Participating in Amphibious Landing Exercises, September 2021

Ex. 2020A	Ship Name	Length / Gross Tonnage	Owner
Yes	BO HAI MA ZHU	590 ft / 33,400 t	Shandong Bohai Ferry Co. (Bohai Ferry)
No	BO HAI CUI ZHU	590 ft / 34,200 t	Shandong Bohai Ferry Co. (Bohai Ferry)

The BO HAI MA ZHU and the BO HAI CUI ZHU conducted an amphibious landing exercise that appeared to be executed in a single morning. For this one-day event, the two RO-RO ferries sailed over 1,000 nautical miles each way, without stopping in a port. The two ferries arrived east of Dongshan Island on 2 September 2021 and anchored 1,000 yards off of a rocky shore and apparently took on fuel. The ships may have also on-loaded exercise forces or, more likely, they already had forces on board and were waiting for the exercise to commence. They departed their anchorage on the evening of 3 September, sailed in a 200 nautical mile circle, and arrived in Dacheng Bay on the morning of 4 September (Figure 39).<sup>98</sup>

The BO HAI MA ZHU arrived first in Dacheng Bay and stopped six nautical miles offshore for about an hour. As the BO HAI MA ZHU withdrew to an anchorage a few miles away to wait for its sister ship, the BO HAI CUI ZHU arrived at the same offload point and stopped for over two hours. AIS weather data indicates there was little-to-no wind at the time of the likely offload activity.<sup>99</sup>

<sup>96</sup> AIS position data, ZHONG HUA FU XING (MMSI 412283000), BO HAI ZHEN ZHU (MMSI 413409000), BO HAI ZUAN ZHU (MMSI 414210000), DA FENG GANG LI MING HAO (MMSI 413239310), SHENG TAI (MMSI 412081630), and TIAN ZHU SHAN (MMSI 412076010), September 5-11, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>97</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and BO HAI CUI ZHU (MMSI 414096000), August 30-September 7, 2021, [www.marinetraffic.com](http://www.marinetraffic.com). In total, the BO HAI MA ZHU was out of commercial ferry service for 45 days to support the PLA from mid-July through mid-September 2021.

<sup>98</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and BO HAI CUI ZHU (MMSI 414096000), September 1-4, 2021, [www.marinetraffic.com](http://www.marinetraffic.com). According to AIS data, the ships likely refueled with the tanker HAI GONG 169 (MMSI 412704030).

<sup>99</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and BO HAI CUI ZHU (MMSI 414096000), September 4, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).



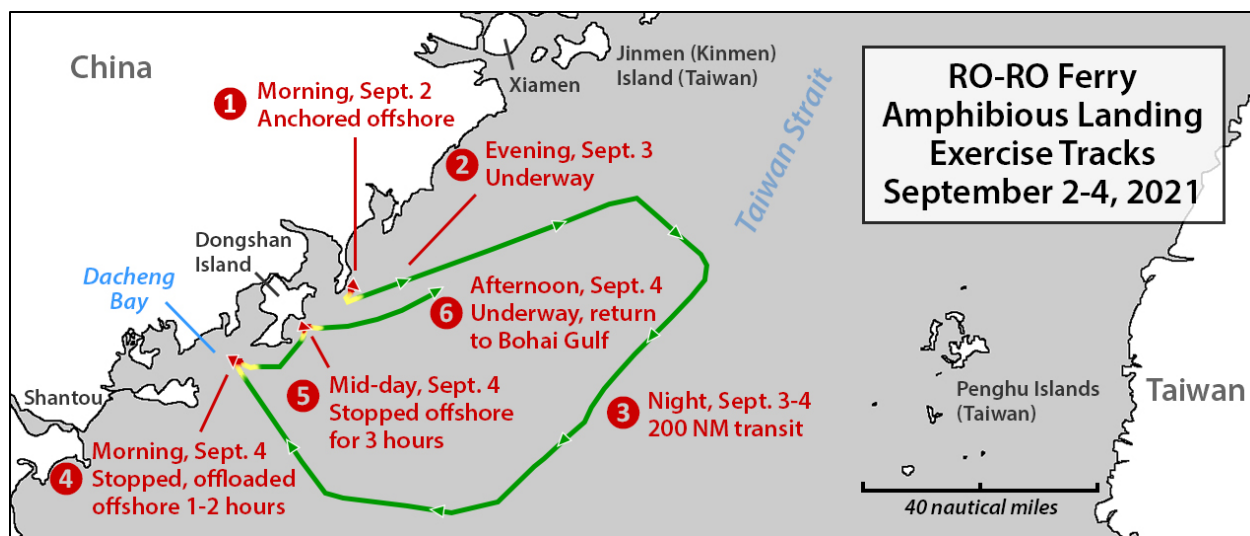


Figure 39. RO-RO Ferry Amphibious Landing Exercise Tracks, September 2-4, 2021

The PLA released photographs of amphibious assault vehicles deploying from LSTs in relatively calm waters in what was identified as a 4 September 2021 Eastern Theater amphibious assault exercise. That exercise is likely the same landing event in which the RO-RO ferries participated (Figure 40).<sup>100</sup> Medium-resolution satellite imagery taken during the BO HAI CUI ZHU's stop appears to show several boats or amphibious vehicles departing from the stern ramp of the ferry. A stream of boats and vehicles seen in the image is apparently proceeding to the landing beach. The RO-RO ferries' offload area is over five nautical miles offshore, behind a line of ships—probably the PLAN LSTs in the photograph deploying amphibious armor (Figure 41).<sup>101</sup>



Figure 40. Official Photo of a PLA Amphibious Assault Exercise, 4 September 2021 (China Military Online)

<sup>100</sup> "Amphibious Assault Vehicles in Maritime Training Exercise," *China Military Online*, September 12, 2021, [http://eng.chinamil.com.cn/view/2021-09/12/content\\_10088512.htm](http://eng.chinamil.com.cn/view/2021-09/12/content_10088512.htm).

<sup>101</sup> Planet Labs PlanetScope, Image ID: 20210904\_024655\_30\_2406, September 4, 2021, Dacheng Bay, China, 23.575N, 117.218E, [www.planet.com](http://www.planet.com). The clouds in the handheld image appear in the satellite image to the south, just outside of this cropped satellite image.

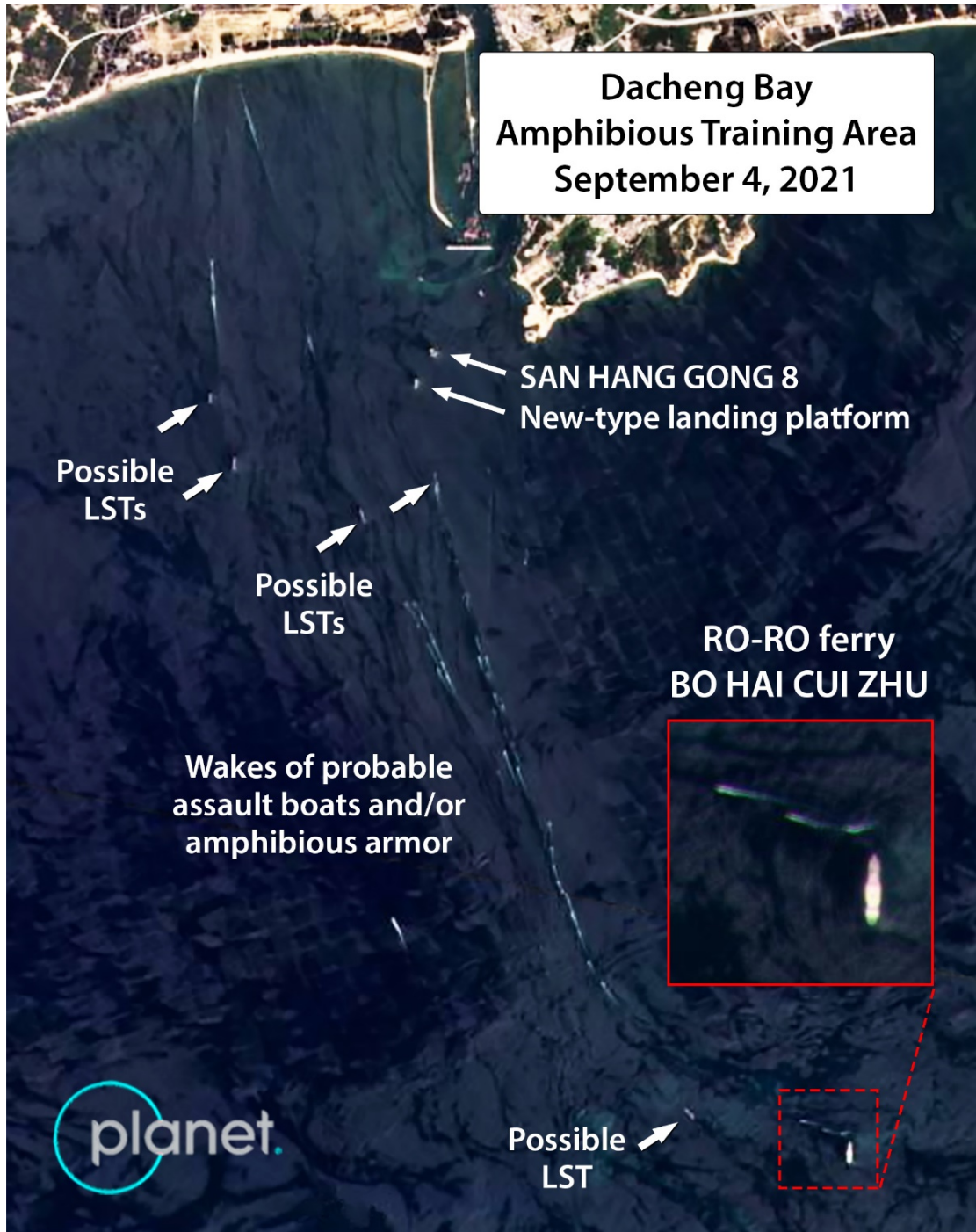


Figure 41. Amphibious Assault Exercise Integrating PLAN LSTs and RO-RO Ferries (© 2021 Planet Labs)

After offloading, both ferries stopped offshore near Dongshan Island for several hours. This could have been to offload additional equipment or personnel or to on-load the forces they had just deployed to the exercise area. Both ships departed the anchorage on the afternoon of 4 September 2021 and proceeded directly back to the Bohai Gulf, arriving on 7 September.<sup>102</sup>

<sup>102</sup> AIS position data, BO HAI MA ZHU (MMSI 414211000) and BO HAI CUI ZHU (MMSI 414096000), September 4-7, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

### *Floating Causeway Test and Evaluation*

From 12-25 September 2021, two RO-RO ferries, the SHENG SHENG 2 and BO HAI ZHEN ZHU, conducted docking and probable test and evaluation with a new-type floating causeway system in Dacheng Bay, on the border between Fujian and Guangdong provinces. The list of vessels that participated in the causeway test and evaluation—the two RO-RO ferries, a semi-submersible barge, and three tugs—appears in Table 7.

Table 7. Civilian Vessels Participating in New-Type Floating Causeway Test and Evaluation

Ex. 2020A	Ship Name	Type	Length / Gross Tonnage	Owner
No	SHENG SHENG 2	RO-RO	541 ft / 20,400 t	Weihai Haida Passenger Transportation Co. (Bohai Ferry)
Yes	BO HAI ZHEN ZHU	RO-RO	538 ft / 24,000 t	Shandong Bohai Ferry Co. (Bohai Ferry)
Yes	SAN HANG GONG 8	Heavy Lift	213 ft / Unk.	China Communications Construction Co.
Yes	SAN HANG TUO 4007	Tug	147 ft / 842 t	China Communications Construction Co.
No	GU GANG TUO 1	Tug	125 ft / Unk.	Unknown
No	JIN SHENG TUO	Tug	174 ft / Unk.	Unknown

### New-Type Floating Causeway

The September 2021 Dacheng Bay event revealed a new system, referred to here as a floating causeway to distinguish it from the floating pier system used in the 2020 exercise.<sup>103</sup> This new floating causeway system bears a much closer resemblance to the U.S. Navy INLS than its predecessor. Longer than the PLA's original floating pier system, it extends approximately 1475 feet (450 meters) from the shore. Like INLS and the PLA's floating pier system, the causeway is modular. The new system still appears to rely on a large semi-submersible barge at the head of the causeway for RO-RO ships to dock. The same semi-submersible barge that participated in Exercise EASTERN TRANSPORTATION-PROJECTION 2020A, the SAN HANG GONG 8, was noted operating with the floating causeway system in Dacheng Bay in 2021 (Figure 42).<sup>104</sup>

<sup>103</sup> Observed landing activity took place on the beach in Fujian's Zhao'an County adjacent to Gongkou Harbor.

<sup>104</sup> Michael Dahm and Conor Kennedy, "Ferrying the People's Liberation Army Ashore," Center for International Maritime Security, September 9, 2021, <https://cimsec.org/civilian-shipping-ferrying-the-peoples-liberation-army-ashore/>; Planet Labs PlanetScope, Image ID: 20210906\_024842\_1105, September 6, 2021, Dacheng Bay, China, 23.620N, 117.202E, [www.planet.com](http://www.planet.com).



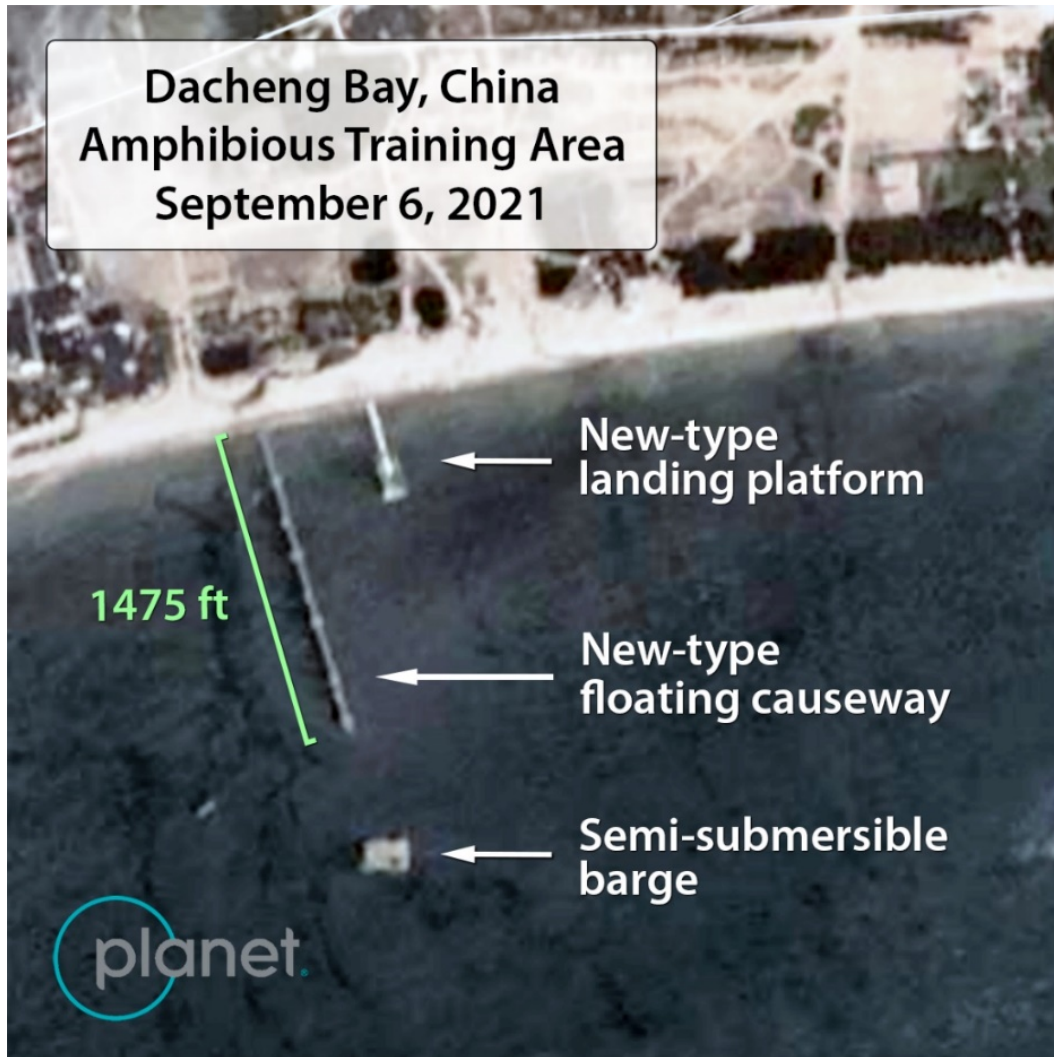


Figure 42. New-Type Floating Causeway and Semi-Submersible Barge (© 2021 Planet Labs)

Unlike the older PLA floating pier system, the new-type floating causeway system appears to be self-propelled. Medium-resolution satellite imagery on 10 September 2021 shows six sections of the floating causeway apparently moving toward the semi-submersible barge under their own power (Figure 43).<sup>105</sup> Forty minutes later, a high-resolution satellite image captured the six modules adjacent to the semi-submersible barge. Propulsion units appear to be affixed to the sides of the causeway modules. A tug was apparently preparing to tow the barge toward the shoreline where the causeway was later assembled (Figure 44).<sup>106</sup>

<sup>105</sup> Planet Labs PlanetScope, Image ID: 20210910\_015856\_01\_245c, September 10, 2021, Dacheng Bay, China, 23.620N, 117.202E, [www.planet.com](http://www.planet.com).

<sup>106</sup> Planet Labs SkySat, Image ID: 20210910\_023851\_ssc18\_u0001, September 10, 2021, Dacheng Bay, China, 23.609N, 117.183E, SkyWatch EarthCache, <https://www.skywatch.com>. AIS position data, SAN HANG GONG 8 (MMSI 413378280) and JIN SHEN TUO (MMSI 414270090), September 10, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).





Figure 43. Floating Causeway Underway (© 2021 Planet Labs)



Figure 44. Floating Causeway and SAN HANG GONG 8 Semi-Submersible Barge (© 2021 Planet Labs)<sup>107</sup>

#### New-Type Landing Platform

August and September 2021 commercial satellite imagery of the PLA's Dacheng Bay amphibious training area also revealed what is likely a new-type of landing platform. Like the floating pier systems, this platform may solve the previously mentioned challenges of large tidal ranges and mud flats in amphibious landing areas. The landing platform probably allows shallow-draft amphibious assault ships and landing craft to dock with and unload at the platform. By utilizing the platform to transfer vehicles and equipment to the beach, amphibious ships would not need to beach themselves to load or unload and risk getting stranded on the flats at low tide.

<sup>107</sup> Includes content sourced via SkyWatch Space Applications Inc.

The platform measures approximately 215 x 98 feet (65 x 30 meters). It appears to have four vertical posts that may house pilings that would extend to the bottom to provide stability when the platform is positioned in the surf zone. The 270-foot (82 meter) ramp extends from the platform to the beach as shown in the inset in Figure 45.<sup>108</sup> No vessels were noted docking with the landing platform in August and September 2021 commercial satellite imagery.



Figure 45. New-Type Landing Platform with 270-foot Extendable Ramp (© 2021 Planet Labs)<sup>109</sup>

### Test and Evaluation Event Summary

The SHENG SHENG 2 left the Bohai Gulf and headed south on 7 September 2021. The BO HAI ZHEN ZHU concluded its participation in the 2-8 September mobility exercise, departed Lianyungang on 8 September, and proceeded to follow the SHENG SHENG 2 to Dacheng Bay. The SHENG SHENG 2 arrived at an anchorage off of Dongshan Island on 10 September. The BO HAI MA ZHU arrived on 12 September after a brief stop for fuel in Xiamen.<sup>110</sup>

Commercial satellite imagery indicates the new floating causeway system was set up and taken down several times on the beach in Dacheng Bay from 6-14 September 2021. This was likely training for the causeway operators. The causeway sections can be seen maneuvering near or assembled with the SAN HANG GONG 8 semi-submersible barge, which acted as a head for the causeway.<sup>111</sup> If the

<sup>108</sup> Planet Labs SkySat, Image ID: 20210910\_023851\_ssc18\_u0001, September 10, 2021, (Inset: Planet Labs PlanetScope, Image ID: 20210906\_024842\_1105, September 6, 2021), Dacheng Bay, China, 23.622N, 117.207E, SkyWatch EarthCache, <https://www.skywatch.com>.

<sup>109</sup> Includes content sourced via SkyWatch Space Applications Inc.

<sup>110</sup> AIS position data, SHENG SHENG 2 (MMSI 413328380) and BO HAI ZHEN ZHU (MMSI 413409000), September 7-12, 2021, [www.marinetraffic.com](https://www.marinetraffic.com).

<sup>111</sup> Planet Labs PlanetScope, Image ID: 20210906\_024842\_1105, September 6, 2021; 20210907\_015725\_28\_2445, September 7, 2021; 20210908\_024400\_76\_240a, September 8, 2021; 20210910\_015853\_71\_245c, September 10, 2021; 20210914\_022254\_1039, September 14, 2021, Dacheng Bay, China, 23.617N, 117.198E, [www.planet.com](https://www.planet.com).

SHENG SHENG 2 was supposed to have docked with the barge and the floating causeway during this week, the ship failed to achieve its objective. The ferry left the Dongshan Island anchorage and took up position nine nautical miles offshore in Dacheng Bay on 13 September. However, there are no indications the ship approached the floating causeway. The SHENG SHENG 2 returned to the Dongshan anchorage on 14 September and then departed two days later to make the 1,000 nautical mile trek back to the Bohai Gulf.<sup>112</sup>

The BO HAI ZHEN ZHU did complete docking evolutions with the semi-submersible barge and the floating causeway. Details of these events, including the numbers of docking attempts and the time docked, could not be determined from available AIS data. It appears that the BO HAI ZHEN ZHU turned off its AIS terminal from 12-25 September 2021.<sup>113</sup> However, commercial satellite imagery captured what was almost certainly the BO HAI ZHEN ZHU 1,000 yards from the floating causeway on 16 September (Figure 46).<sup>114</sup> AIS data indicates the tug next to the RO-RO ferry maneuvered to the semi-submersible barge 90 minutes after this image was taken. This may have been the first time a RO-RO ship docked with the barge and causeway during this evolution.<sup>115</sup>



Figure 46. RO-RO Ferry Preparing to Dock with Floating Causeway (© 2021 Planet Labs)

The BO HAI ZHEN ZHU moored at an undeveloped quay on Huyetuo Island, just east of Dongshan Island from 20-21 September 2021. Satellite imagery does not indicate any activity on the quay, but the ship may have taken on personnel or vehicles for docking maneuvers with the barge and

<sup>112</sup> AIS position data, SHENG SHENG 2 (MMSI 413328380), September 12-19, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>113</sup> AIS position data, BO HAI ZHEN ZHU (MMSI 413409000), September 12-25, 2021, [www.marinetraffic.com](http://www.marinetraffic.com). The ship's AIS terminal was turned on briefly when it went into port from 20-21 September.

<sup>114</sup> Planet Labs PlanetScope, Image ID: 20210916\_022129\_103c, September 16, 2021, Dacheng Bay, China, 23.607N, 117.182E, [www.planet.com](http://www.planet.com).

<sup>115</sup> AIS position data, SAN HANG GONG 8 (MMSI 413378280), GU GANG TUO 1 (MMSI 412701210), and JIN SHENG TUO (MMSI 414270090), September 16, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).



causeway.<sup>116</sup> Despite the lack of AIS data after the ship departed the quay, the ferry proceeded back to Dacheng Bay and docked with the semi-submersible barge and floating causeway several times from 22-25 September. The BO HAI ZHEN ZHU can be seen in medium-resolution commercial satellite imagery backed into the semi-submersible barge on 22, 23, and 25 September. The BO HAI ZHEN ZHU's wake in the 25 September image likely indicates the ship was backing into the semi-submersible barge when the image was taken (Figure 47).<sup>117</sup> Following these docking evolutions, the BO HAI ZHEN ZHU departed Dacheng Bay on 25 September 2021 and proceeded back to its homeport on the Bohai Gulf, arriving on 29 September.<sup>118</sup>



Figure 47. BO HAI ZHEN ZHU Docking with SAN HANG GONG 8 and Floating Causeway (© 2021 Planet Labs)

The SAN HANG GONG 8, towed by its tug, the SAN HANG TUO 4007, departed Dacheng Bay on 26 September 2021 and returned to Xiamen on 27 September.<sup>119</sup> The floating causeway was missing from commercial satellite imagery of Dacheng Bay after 25 September. It was probably disassembled and moved out of the area. The floating causeway's homeport or storage location could not be determined.

## 2021 Exercise Analysis

The scope and diversity of 2021 military-civil fusion exercises involving civilian shipping was on par with what was observed in the JLSF exercise EASTERN TRANSPORTATION-PROJECTION 2020A. Discounting tugs and smaller craft, the 2020 and 2021 exercise series employed the same number of major civilian vessels—eight large RO-RO ferries and two general cargo ships. Five of the merchant ships participated in both the 2020 and 2021 exercise activity identified in this report.<sup>120</sup>

<sup>116</sup> Planet Labs PlanetScope, Image ID: 20210920\_232516\_1054, September 20, 2021, Huyetuo Island, China, 23.783N, 117.581E, [www.planet.com](http://www.planet.com). AIS position data, BO HAI ZHEN ZHU (MMSI 413409000), September 20-21, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>117</sup> Planet Labs PlanetScope, Image IDs (left to right): 20210920\_015652\_73\_242d, September 20, 2021; 20210922\_015944\_06\_2432, September 22, 2021; 20210923\_022334\_37\_1063, September 23, 2021; 20210925\_024717\_35\_240f, September 25, 2021, Dacheng Bay, China, 23.611N, 117.179E, [www.planet.com](http://www.planet.com). Dacheng Bay was overcast on September 24 precluding imagery collection.

<sup>118</sup> AIS position data, BO HAI ZHEN ZHU (MMSI 413409000), September 25-29, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>119</sup> AIS position data, SAN HANG GONG 8 (MMSI 413378280) and SAN HANG TUO 4007 (MMSI 412704260), September 26-27, 2021, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>120</sup> Beyond routine inter- or intra-theater movement of forces, these ships may have participated in others exercises in 2020-2021 not identified in the author's research.

Combining ships and crews from previous exercises into current and future exercises represents a characteristic pattern of Chinese military training in which experience is passed from units and organizations to others through practice rather than transferring knowledge through formal training. Seeing the same ships from the same companies in follow-on exercises should be expected as the PLA seeks to pass on and build upon the experiences that each crew acquired in the 2020 and 2021 exercises.

The 2021 exercise activity evolved the use of civilian shipping to include direct combat support roles for the RO-RO ferries, offloading amphibious forces offshore in beach landings. In using civilian RO-RO ferries as auxiliary landing ships in the 2021 exercises, the ships demonstrated defensive tactics that might mitigate potential adversary threats. Reactions to simulated enemy threats were not detected in the 2020 over-the-shore logistics exercise. In July and August 2021 training, RO-RO ferries in Qianhai and Honghai Bay took up offload positions three to four nautical miles offshore. In the Honghai Bay exercise, ferries rapidly withdrew from the offload areas after apparently deploying amphibious forces. In September 2021 exercises, RO-RO ferries took up offload positions more than five nautical miles offshore behind a line of PLAN amphibious ships that might screen the civilian vessels from threats.

The September amphibious landing exercises appear to have been synchronized with mobility exercises. Based on external observations of events, the RO-RO ferry landing group supported a beach assault with PLAN amphibious ships on 4 September 2021. Concurrently, military-civilian logistics forces loaded on 4 September and departed Xiamen on 5 September. Those ships offloaded a few days later hundreds of miles away, possibly simulating an offload in a captured foreign port. Later, experimentation with the types of over-the-shore logistics technologies observed in 2020 continued in 2021 with the test and evaluation of the PLA's new floating causeway system.

The apparent delays in test and evaluation of the floating causeway may have revealed some issues with the new system. In September 2021, the SHENG SHENG 2 waited offshore for several days without approaching the beach where the causeway was being assembled and taken down. Eventually, the RO-RO ferry departed the area and returned to the Bohai Gulf having spent twelve days away from its homeport with little-to-no exercise activity to show for it. Later, the BO HAI ZHEN ZHU did successfully dock with the causeway and semi-submersible barge. Whatever the cause of the delays in docking with the causeway system, the events underscore the difficulties in employing new technologies and procedures in a challenging maritime environment.

The 2021 exercise activity took civilian Bohai Gulf-based ferries far from their homeports for long periods of time. The 2020 JLSF exercise straddled the PLA's Eastern and Northern Theaters, a relatively close exercise location for the ferries to transit down and back over a few days supporting individual exercise events. 2021 exercises extended to the far reaches of southern China taking the ferries away from commercial activity for weeks at a time. This could reflect the commitment of the civilian ferry operators to their military obligations. Alternatively, the 2020-2021 COVID-19 pandemic and the accompanying limitations on commercial and leisure travel may explain the extent of their involvement. It is possible that the ferries were simply underutilized during the pandemic and the ferry companies welcomed the subsidies they likely received from the PLA to support military exercises.

Many of the large Bohai Gulf-based RO-RO ferries are reportedly built to national military standards expressly to support military operations. It is nevertheless noteworthy that these ferries deployed from northern to southern China when other large ferries that service routes to and from Hainan Island might have been used to support PLA exercises.

## Conclusions

As of 2021, the PLA and its reserve civilian merchant fleet are probably unable to provide the maritime logistics in austere or challenging environments necessary to support a cross-strait invasion of Taiwan. Although 2021 exercises employed RO-RO ferries as reserve amphibious landing ships, deploying infantry in assault boats or amphibious armor, this likely represents a very modest augmentation for a potential PLA landing force. Despite concerns that China could bring its vast fleet of merchant ships to bear on an operation to invade Taiwan or conduct some other military operation, there are practical realities that should limit such concerns. The complexity of amphibious operations appears to have limited military-civil fusion to a handful of select ships that provide the PLA with relatively modest capacities.

The apparent increase in civilian ship participation in PLA amphibious exercises may simply reflect the PLA taking advantage of excess RO-RO ferry availability during the COVID-19 pandemic. However, the appearance of new amphibious logistics technologies, probably years in the making, suggests otherwise. The continued integration of civilian ships into PLA operations will be telling, especially as exercise participation extends to ships other than the large Bohai Gulf-based ferries. Once procedures have been established and the PLA has gained some experience integrating civilian vessels into amphibious operations, there may be great potential to rapidly scale up the use of civilian ships in combat support or amphibious logistics roles. The expanding roles for merchant ships in military operations may present challenges for China's adversaries in terms of detecting, targeting, and countering these civilian vessels.

However, scaling up combat and logistics operations can be a challenge that increases geometrically in complexity as numbers of participating forces and volumes increase. Loading and moving eight civilian ships once is very different from loading and moving eighty ships once or, more likely, coordinating dozens of ships to load and move materiel, equipment, and personnel for days or weeks, all while taking enemy fire. In the 2020 over-the-shore logistics exercise, the landing and unloading operations appear to have been completely unopposed. In the 2021 logistics operations, there was also no evidence observed in the tracks of the ships or satellite imagery that the exercise sought to simulate the presence of an enemy force. No defensive actions (e.g. convoying, escorting, evasion or diversion) were observed. However, based on observations of defensive actions taken in the 2021 landing exercises, the PLA and its merchant support fleet may be changing their mindset about putting these ships in harm's way.

The appearance of a new floating causeway system and landing platform in 2021 indicates that the PLA is investing in better over-the-shore logistics technologies. These platforms could provide the PLA with significant capabilities and access to beach landing areas with military or civilian ships. That said, Project 019 was initiated in 2001 and heralded by the PLA as a major (if not widely known) project to create a capability for at-sea transfer and unloading of materiel and equipment in austere conditions. Prototype capabilities appeared over a decade later. By 2020, it appeared the PLA was still utilizing those same prototype capabilities in Exercise EASTERN TRANSPORTATION-PROJECTION 2020A. Given these long timelines for development and the challenges the PLA may be experiencing with its new floating causeway system, it is unlikely the PLA will rapidly increase its over-the-shore logistics capability in the next several years.

A group of Chinese military authors affiliated with the PLA's Military Transportation University and the JLSF Transportation and Projection Bureau provide some insights about the state of PLA over-the-shore logistics capabilities. In January 2020, they wrote that the Chinese military's "dockless unloading equipment" (无码头卸载装备) is essentially a "technical reserve." Most of the specialized

equipment are prototypes, according to these PLA authors. They observe that dockless unloading equipment is usually kept in storage and seldom used, which provides significant challenges for training and procuring the necessary volume of equipment that might otherwise support large-scale operations. In their critique, they conclude, “[The Chinese] military’s dockless unloading is still in its infancy. There are still many weak links.”<sup>121</sup> That January 2020 assessment is likely accurate based on detailed observations of Exercise EASTERN TRANSPORTATION-PROJECTION 2020A and 2021 exercise activity. How those nascent capabilities grow in the coming years should be watched closely.

The 2020 and 2021 exercises integrating civilian shipping, especially large RO-RO ferries, may have provided the PLA and its JLSF with a baseline assessment for where the Chinese military is with regard to large-scale amphibious operations and logistics. The lessons learned from the JLSF’s experience over the summer of 2020 may provide a roadmap for the types of capabilities and capacities the JLSF and the larger PLA joint force may need for future operations. Depending on the PLA’s take-aways, one might expect to see what are probably still prototypes like the floating pier system, the new floating causeway, and the new landing platform go through additional experimentation and exercises, possibly leading to large-scale production of these types of capabilities to support multiple landing points in a Taiwan invasion. Similarly, ad-hoc capabilities like deck barges modified into an at-sea RO-RO unloading platform may evolve into tailored systems with features supporting the unique requirements for loading and unloading military equipment from both naval vessels and civilian ships at-sea.

Despite these seemingly negative critiques of PLA amphibious landing capabilities in general, and over-the-shore, “dockless” logistics capabilities in particular, it would be a mistake to underestimate the ingenuity and tenacity of the PLA. An evaluation of these 2020 and 2021 exercises should be considered in the context of a Chinese approach to problem solving rather than a Western opinion about how amphibious logistics *should* be done. The PLA’s reserve merchant fleet probably does not currently have the capabilities and capacities to support a *disciplined, effective, and efficient* amphibious operation with over-the-shore logistics in support of a Taiwan invasion. However, efficiency is not necessarily a prerequisite for success, especially for the PLA.

Clearly, the PLA has started to work through what may be required to support an invasion of Taiwan and how exactly that will be done. The Chinese Communist Party can leverage a national mobilization of maritime shipping on a massive scale and the PLA clearly intends to exploit that capability. Such a mobilization of civilian shipping to support cross-strait operations may be very high risk and could involve extremely high losses. However, there is a certain “quality in quantity.” There are few challenges related to efficiency and attrition that the Chinese military could not simply address with overwhelming mass and a tolerance for loss. Future exercises like those explored in this report merit close scrutiny to provide indications of the trajectory of PLA amphibious and logistics capabilities.

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<sup>121</sup> Luo et al, “Construction and Enlightenment of Normandy Landing Artificial Port,” 17-18.



## About the Author

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## Sources and Methods

This report fuses a variety of publically 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.<sup>122</sup> Google Earth images are attributed to the commercial satellite provider and published under the Google Earth terms of service.<sup>123</sup> The report also features commercial satellite imagery from Planet Labs Inc., the leading provider of global daily Earth data. Medium-resolution satellite imagery from the PlanetScope constellation (ground sample distance (GSD) ~3.7 meters) was obtained through Planet’s *Education and Research Program*, which allows the publication of PlanetScope imagery for non-commercial research purposes.<sup>124</sup> High-resolution satellite imagery from Planet’s SkySat constellation (GSD ~0.5 meters) was purchased by the author through SkyWatch Space Applications Inc.<sup>125</sup> 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 Labs retains copyrights to the underlying PlanetScope and SkySat images, which should not be reproduced without the expressed permission of Planet Labs.

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<sup>122</sup> Marine Traffic, [www.marinetraffic.com](http://www.marinetraffic.com).

<sup>123</sup> “General Guidelines,” Google Maps & Google Earth, [https://www.google.com/intl/en-GB\\_ALL/permissions/geoguidelines/](https://www.google.com/intl/en-GB_ALL/permissions/geoguidelines/).

<sup>124</sup> “Education and Research Program,” Planet Labs, <https://www.planet.com/markets/education-and-research/>.

<sup>125</sup> SkyWatch, <https://www.skywatch.com/>.