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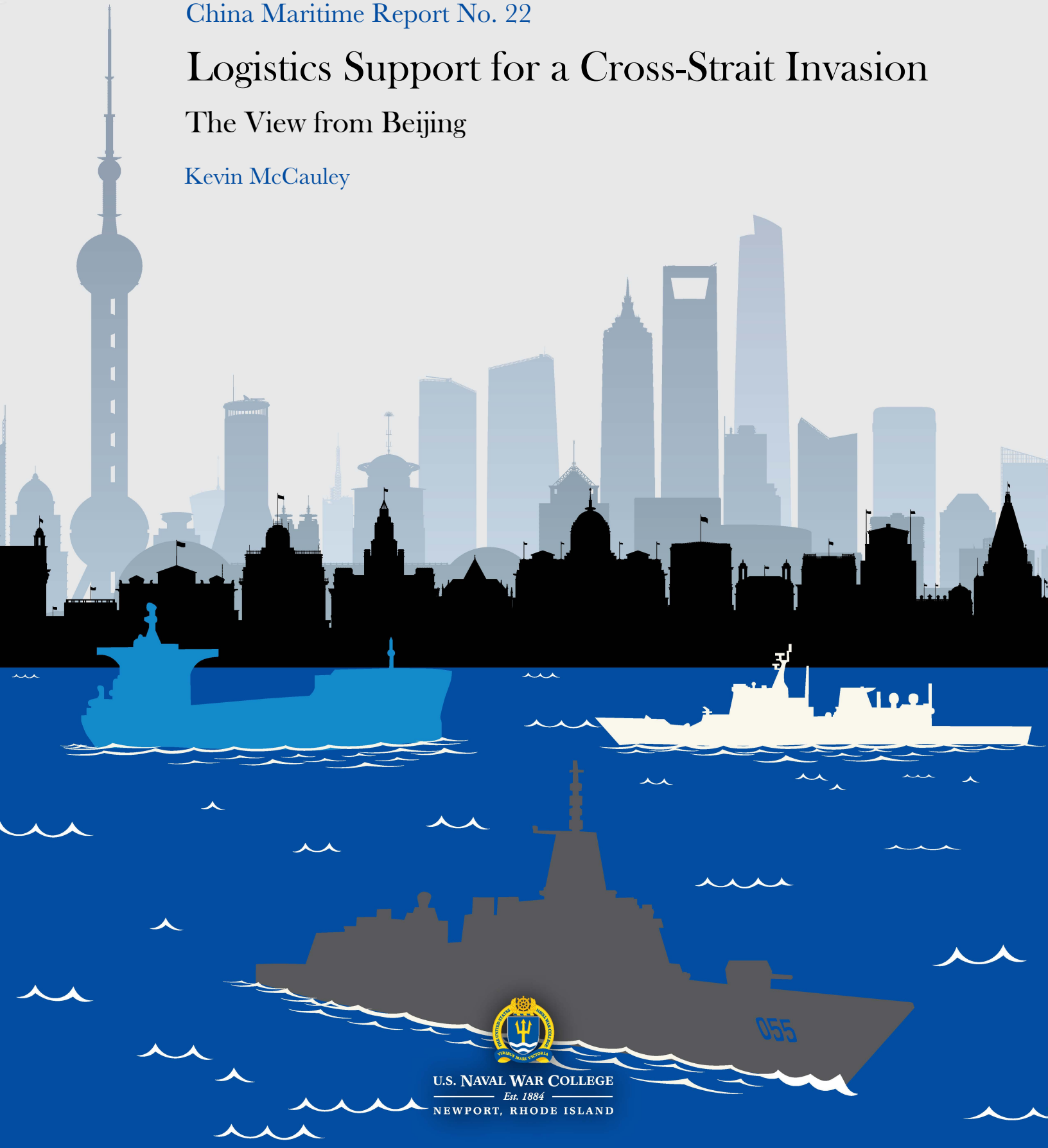
Logistics Support for a Cross-Strait Invasion

The View from Beijing

Kevin McCauley



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Summary
The PLA believes that logistics support is one of the key determinants of a successful large-scale invasion of Taiwan. Logistics support includes transport, materiel and oil supply, medical care, search and rescue, logistics infrastructure protection, and maintenance of war materiel reserves. Despite the recognized importance of logistics support, it is likely the PLA does not currently possess the requisite logistics capabilities to successfully support a large-scale amphibious landing on Taiwan and a possible protracted conflict involving the United States and allies. Key deficits include a lack of amphibious ships (both military and civilian), transport aircraft, and war reserves. The PLA also continues to face difficulties with landing the requisite logistics supplies during the critical beach assault phase, constructing maritime transfer platforms or temporary wharves to sustain resupply if intact ports are not rapidly captured, establishing a landing base for logistics operations, maintaining the flow of logistics during on-island combat, and establishing strategic war reserves to support the large-scale operation and possibly prolonged conflict. These problem areas might be resolved with several years of sustained effort and complex training.

Introduction

The People's Liberation Army (PLA) believes that logistics support is one of the key elements determining the success of a large-scale joint landing operation. The initial support for the landing assault force and the over-the-shore logistics support are the most difficult and critical logistics delivery missions. The PLA actively conducts research into logistics support for amphibious warfare and has identified many problems requiring resolution before being able to successfully support a large-scale landing operation. The PLA does not currently possess the requisite logistics capabilities including equipment, specialized logistics forces, amphibious ships, transport aircraft, and war reserves to successfully support a large-scale amphibious landing on Taiwan. Extensive logistics exercises and training on multiple mission areas necessary to ensure the successful execution of the complex and difficult logistics support plan do not appear to have taken place.

PLA logisticians consider transport, materiel and oil supply, medical, search and rescue, logistics infrastructure protection, and maintenance of war materiel reserves as the main functions of logistics support in a large-scale campaign including blockade, joint firepower strikes, and island landing operations. Such a conflict could escalate with foreign intervention and chain reaction conflicts initiated by countries taking advantage of Beijing's initiation of operations against Taiwan. Escalation beyond the island landing campaign would further stress strained logistics capabilities.

The PLA is working to construct a precision, just-in-time logistics capability and incorporate intelligent technologies to improve planning and decision making, and to enable just-in-time support to mobile operational units. The logistics integrated command platform will provide a common operating picture and support a fast and efficient logistics system when fully deployed. Logistics forces rely heavily on the Beidou satellite navigation positioning system for communications and coordinating mobile logistics support to dispersed operational units. The Joint Logistic Support Force is developing multiple networks, databases, and a data cloud platform to support logistics planning and supply to units in combat.

The PLA is expanding its logistics capabilities, including air and maritime transport capabilities. Civil military integration allows the PLA to leverage civilian assets to support delivery of forces and materiel. The National Defense Mobilization Law of 2010 supports mobilization of national resources and promotes civil military integration. Logistics mobilization of civilian transportation assets is enabled by the 2017 National Defense Transportation Law, intended to strengthen the integration of military requirements into civilian transportation resources. However, numerous PLA

sources detail problems with a lack of suitable civilian ships and aircraft, equipment not meeting military standards, as well as poor training.[1]

This report examines PLA logistics support for a large-scale invasion of Taiwan. It draws heavily from a 2017 volume entitled *Operational Logistics Support*, published by the PLA's All Army Logistics Academic Research Center.[2] The primary focus of this book is on logistics support to a large-scale amphibious operation against Taiwan. It is part of a series of logistics publications intended to support Central Military Commission decision making. This "internal" (内部) publication provides highly detailed information on PLA logistics doctrine and capabilities. It also discusses PLA weaknesses and offers proposals for remedying them.

Strategic Issues Increasing Logistics Requirements

The Central Military Commission's (CMC) new military strategic guidelines for the "new era" views the main threat as coming from the sea because of territorial and maritime rights issues. The joint island landing campaign against Taiwan is the primary focus of military preparations and the main military means of enforcing Taiwan's integration with the People's Republic of China (PRC).[3] The PLA's perception of the security environment during an operation against Taiwan recognizes several escalatory events: the possibility of U.S. and Japanese intervention including a blockade; a chain reaction in other directions including actions by countries such as the Philippines with territorial claims in the South China Sea, conflict in the disputed PRC-Indian border, or conflict on the Korean peninsula; and international sanctions and embargo.[4]

These strategic scenarios could have a significant impact on logistics capabilities and requirements during a large-scale landing operation against Taiwan:

- U.S. and Japanese intervention would increase the scale, scope, and intensity of the conflict, requiring the PLA to deploy forces and logistics assets to counter these actions. Initiating operations to deny access to the area of operations increases the requirements for the PLA Air Force (PLAAF), Navy (PLAN), Rocket Force (PLARF), Strategic Support Force (PLASSF), and logistics force. Intervention by the U.S. would deny Beijing's preference for a war of quick decision, forcing the PRC into preparations for a protracted conflict.[5]

- A blockade possibly combined with international sanctions and an embargo would increase the importance of strategic materiel reserves and acquisition of alternate sources of resupply. Russia would likely provide logistics support and access to resupply as far as possible, along

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[1] 中华人民共和国国防动员法 [PRC National Defense Mobilization Law], http://www.mod.gov.cn/regulatory/2016-02/19/content_4618039.htm; 董智高，周磊 [Dong Zhigao and Zhou Lei], 关于海外军事后勤保障力量建设的认识与思考 ["The Understanding and Reflections on Overseas Military Logistics Support Force Construction"], 国防科技 [*National Defense Science & Technology*] 37, no. 2 (April 2016), 83-86; 中华人民共和国国防交通法 ["National Defense Transportation Law of the People's Republic of China"], http://www.mod.gov.cn/regulatory/2016-09/03/content_4724196.htm; also see Kevin McCauley, "China's Logistics Support to Expeditionary Operations," Testimony before the U.S.-China Economic and Security Review Commission, February 20, 2020, https://www.uscc.gov/sites/default/files/McCauley_Written%20Testimony_0.pdf.

[2] 全军后勤学术研究中心 [All Army Logistics Academic Research Center], 作战后勤保障 [*Operational Logistics Support*], (no publishing data) February 2017.

[3] *Operational Logistics Support*, 30-31, 36-37, 167.

[4] Ibid., 30-31, 36-37, 167; "China's National Defense in the New Era," PRC State Council Information Office, July 2019, http://www.xinhuanet.com/english/2019-07/24/c_138253389.htm.

[5] *Operational Logistics Support*, 30-31, 36-37, 167.

with Iran, Pakistan, and some of the Shanghai Cooperation Organization countries. The PRC would need to increase strategic reserves in advance to mitigate the impact of a blockade and a prolonged conflict would require national mobilization.[6]

- The possibility of chain reaction conflicts in the South China Sea, Indian border region, or Korean peninsula would require coordination and support with other strategic directions. Conflicts in secondary directions could draw off support and forces from operations against Taiwan depending on the number and scale of the secondary conflicts.[7]

The PRC's belief that the U.S. could intervene would appear to negate Beijing's desire for a war of quick decision. A large-scale protracted war would place greater emphasis on civil-military integration, people's war, and national mobilization. Civil-military resource sharing and integrated civil-military support would have importance in the areas of materiel supply, transportation, engineering and construction, equipment support, medical care, and mobilization of high-tech logistics equipment and personnel to meet operational requirements.[8]

Operational Issues Affecting Logistics Support

The operational stages, scale, and methods employed in a large-scale landing operation will affect logistics support. The PLA views future warfare as a high intensity, dynamic, non-linear, non-contact, system of systems confrontation with high consumption and destruction. These future warfare characteristics add to the complexity and difficulty of logistics support. The PLA believes a future joint landing operation will include comprehensive employment of strategic deterrence; seizure of air, maritime, and information superiority in the area of operations; a focused blockade to seal and control the area around Taiwan; a large-scale joint firepower campaign; assault landings in Taiwan and possibly some of the outer islands; and on-island operations. Throughout the campaign, information operations, precision strikes, and highly mobile forces will play critical roles. Additionally, operations will expand past the eastern part of Taiwan to seize advantage and strategic initiative to control the space around Taiwan and counter U.S intervention.[9]

Foreign intervention is an important factor affecting PLA logistics operations. Analysis in *Operational Logistics Support* estimates that support for a large-scale landing and on-island operations against Taiwan would last approximately three months. However, U.S. intervention, blockade, and international sanctions and embargo would lead to protracted war. Enemy actions such as information and firepower strikes can disrupt PLA logistics operations, including command and control, interrupting support to operational forces. The threat of precision strikes will necessitate protection and concealment of logistics forces and infrastructure.[10]

Crossing the Taiwan Strait poses great difficulties for the logistics delivery mission. The strait is 220 km wide at the widest point and 130 km at the narrowest point. The tides, waves, currents, winds, weather, beach conditions, and enemy obstacles and defenses pose great challenges to transporting and landing troops and materiel. The logistics support system will support hundreds of thousands of troops implementing blockade, firepower strikes, and landing operations. Embarking, transporting,

[6] Ibid., 30-31, 36-37, 167.

[7] Ibid.,30-31, 36-37, 167.

[8] Ibid., 28, 39.

[9] Ibid., 28.

[10] Ibid., 29, 38, 66, 192-196.

and unloading the immense force and supplies in an unfavorable natural environment and under enemy attack will present an unprecedentedly complex and arduous task.[11]

Logistics will face changing missions during transitions to new operational stages. These missions include supporting forces during the following operational stages: strategic deployment and assembly of forces and supplies to the coast; seizing air, maritime, and information superiority; joint blockade and fire strike operations; embarkation and maritime transport; landing operations; and on-island operations. Support requirements for the PLAN, PLAAF, and PLARF will be high during all operational stages. Such a large operation will demand all the resources of the PRC and PLA including the People's Armed Police, militia, and reserves.[12]

PLA theories for assault landing operations are evolving and attempting to catch up with those of more advanced militaries. Vertical landings, over-the-horizon assault landings, and integrated joint landings are changing the PLA's traditional concept of landing operations. At the same time, PLA theorists estimate that a traditional large-scale landing cannot be replaced in the era of informationized warfare, but rather will be supplemented by airborne, air assault, and over-the-horizon landing methods as these capabilities improve. Evolving concepts for amphibious landings have a significant impact on logistics. Timelines for logistics support are dramatically compressed. The accelerated landing of combat troops will shorten the timelines for meeting critical logistics requirements during the beach assault and seizing of a landing base. According to *Operational Logistics Support*, large numbers of high-tech landing equipment such as air cushion vehicles and wing-in-ground effect vehicles conducting over-the-horizon landings can limit the effects of enemy fire strikes. These systems require high maintenance and are vulnerable to enemy fires. Importantly, they are not yet deployed in large numbers. A higher operational tempo will increase the importance of maintaining command of logistics units and coordination with supported units. This requires a fully integrated command information system and trained command personnel capable of responding to rapidly changing logistics requirements in a dynamic battlefield involving frequent transitions in logistics support and adjustments in the logistics support plan.[13]

Logistics Command and Control

The PLA believes that logistics command should be highly centralized with a decentralized capability to respond at lower echelons to rapidly changing situations; highly mobile to ensure command and coordination of mobile logistics forces; and survivable against enemy fire strikes and information attacks. The strategic to tactical level logistics command includes multiple networks with transportation and delivery, and petroleum, oil, lubricants (POL) having separate command systems from the main logistics command. These command structures flow from the CMC joint operations command center to the theater and to campaign level forces. See Exhibit 1 for an example of the landing campaign logistics organization. The command organization for a landing operation includes the following elements: [14]

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[11] Ibid., 30; 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 ["Problems and Countermeasures of Sea Crossing and Landing Transportation Service Support"], 军事物流 [*Military Logistics*] 35, no. 10 (2016), 166-169.

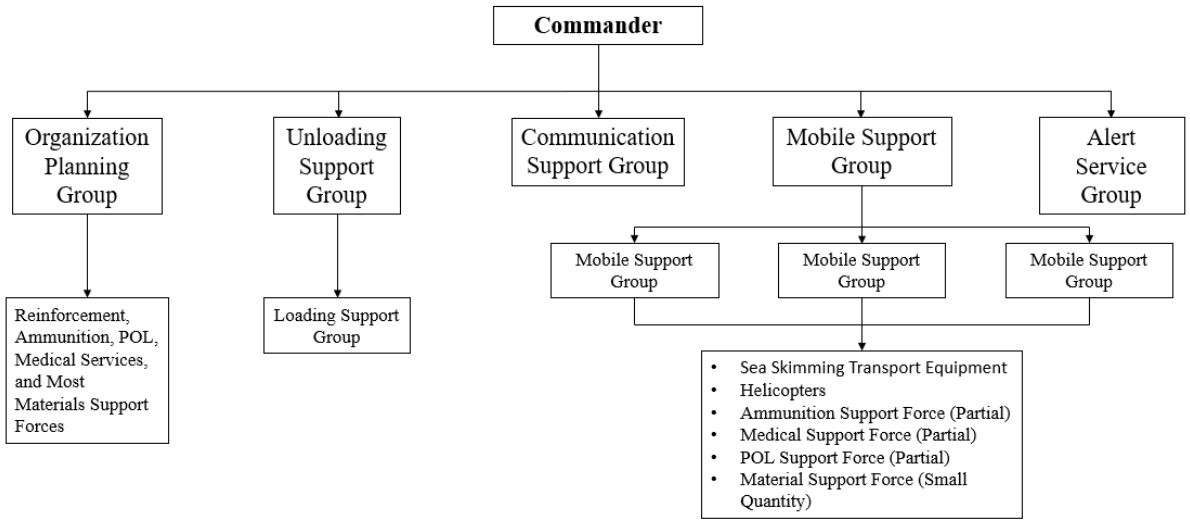
[12] *Operational Logistics Support*, 29, 38.

[13] Ibid.,192-196; Kevin McCauley, "Cultivating Joint Operations Talent," in Roy Kamphausen, ed., *The People of the PLA 2.0*, (Carlisle, PA: US Army War College Press, 2021), https://press.armywarcollege.edu/monographs/944, 237-285.

[14] *Operational Logistics Support*, 196-198; Chen et al, "Problems and Countermeasures of Sea Crossing and Landing Transportation Service Support," 166-169.

- Organization planning group responsible for planning logistics support for the assault force, organization and coordination, air control of vertical delivery support, and reinforcements.
- Mobile support group responsible for command and control of mobile support groups for the assault landing.
- Unloading support group providing command and control of the unloading of materiel, POL, and equipment of the landing support force.
- Communication support group providing communication support and coordination with forward units, and the campaign formation communication hub.
- Alert service group responsible for protection.

Exhibit 1. Landing Force Logistics Command Organization and Force Composition



Ensuring the survivability of command and support units is an important effort. The PLA expects that units in the main operational direction will be reinforced while logistics command and support units in secondary directions receive fewer or no reinforcement. Multiple smaller support units are to be established for redundancy and prevent overall paralysis in the event one group is severely damaged or destroyed. The communication network should be capable of providing stable and resilient communications in a complex electromagnetic environment with the enemy employing soft and hard kill means. Logistics support command is located at sea during the assault landing stage, relying on vulnerable wireless and satellite communications for command and coordination. Communications can be strengthened through the use of advanced frequency hopping radio stations, communication discipline, and burst communications, which can help counter enemy jamming, reconnaissance, and interception. The establishment of auxiliary radio stations to attract enemy interference can protect the main radio communication channels. Radio stations can also be set up to create false communications networks for deception.[15]

[15] *Operational Logistics Support*, 198-200.

Transportation and Delivery

Transportation of forces and materiel for a large-scale landing is a major logistics task requiring strong ground, air, and maritime transportation support capabilities. One PLA source estimates transportation requirements to include 3,000 military trains, one million vehicles, 2,100 aircraft, and more than 8,000 ships to transport troops, equipment, and materiel and evacuate wounded during a large-scale amphibious operation.[16] Another PLA source estimated 550-700 logistics ships, landing ships, and transport aircraft would be required to land materiel on Taiwan.[17] Traffic volume to the southeast coastal embarkation areas and transit across the Taiwan Strait combined with evacuation of large numbers of casualties would be unprecedented. Railways, followed by roads, represent the main transportation means to deliver forces and materiel from the interior to embarkation areas along rivers and the coast. Air and waterway transport will supplement movement as required. Enemy fire strikes on bridges and tunnels in mountainous areas, in addition to strikes on airports, ports and embarkation areas, could cause significant disruption of transportation. These key nodes along lines of communication will require defensive and protective measures.[18]

Theater command coordination for force projection is complicated. The multiple support forces of the military, national and local government, plus civilian enterprise transportation organizations, create command, planning, and coordination problems. An example given in an article written by PLA analysts discusses the following commands and organizations coordinating delivery of forces: the theater joint operations command center; the joint logistic support center command; the headquarters of the participating unit(s); national and local rail, road, water, and air transportation dispatch centers (depending on the situation); and civilian enterprises providing mobilized transportation. The joint logistic support center within a theater assists in planning and use of the civilian and military transportation resources.[19]

A central transportation and delivery headquarters would be established during wartime operations. See Exhibit 2 below. It would mainly comprise the transportation and delivery departments of the Eastern and Southern Theater Commands with augmentation from the PLAAF, PLAN fleets, PLARF bases, and relevant local government departments. The wartime transportation and delivery command system would be established at the strategic (CMC JOCC), theater (joint), and campaign direction levels connecting to subordinate operational forces. The Eastern and Southern Theaters' joint logistics organizations would be responsible for mobilization and distribution of transportation assets, organization of military transportation and mobile support of troops, transportation protection, rush repair, and construction. The transportation and delivery command would be integrated into the operational and logistics command system but relatively independent at the strategic and campaign levels. A centralized command develops a "transportation plan" (输送方案) and "transportation support plan" (输送保障方案). Mobilization and requisition orders are issued for civilian transportation assets and the refitting of ships. The "wartime augmentation plan" (战时扩编方案) will expand motor transport troops, specialized traffic militia, military representative organizations

[16] 李鹏，孙浩，刘思阳 [Li Peng, Sun Hao, and Liu Siyang], 战区联合投送指挥研究 ["Study on Joint Projection Command for Theater Command"], 军事交通学院学报 [*Journal of Military Transportation University*] 21, no. 5 (May 2019), 1-5

[17] Ibid.

[18] *Operational Logistics Support*, 30, 91.

[19] Li et al, "Study on Joint Projection Command for Theater Command," 1-5; *Operational Logistics Support*, 93-94.

along traffic lines, combat readiness departments, and the military catering supply system. The plan will also adjust personnel levels, supplement equipment levels, and clarify deployment and tasks.[20]

Exhibit 2. Transportation and Delivery Command Organization

Echelon and Mission	Participating Organizations
Strategic Transport and Delivery HQ (within CMC Joint Operations Command Center) Mission: Unified transportation plan; mobilize and allocate transportation; organize repair; guide warzone during emergencies; recommend traffic defense measures to operational units	• National Defense Mobilization Department • Logistic Support Department's Transport and Delivery Bureau • Joint Staff Department's Operations Bureau • Traffic management elements of the Ministry of Transport, information industry (telecommunication), civil aviation and public security
Theater Joint Transport and Delivery HQ (Eastern and Southern Theaters) Mission: Organize and protect transportation in the warzone; evacuation of wounded; rush repair; coordination with civil transport	• National Defense Mobilization Department • Joint Logistics Support Force • Transportation and communications personnel from other theaters, Air Force, Navy, Rocket Force, provincial governments and other transportation personnel
Campaign Direction Mission: Assist operational groups with traffic control; transportation maintenance and repair	• Eastern and Southern Theater, and Logistic Support Department transportation personnel

The warzone within the Eastern and Southern Theaters represents a complex geographic environment vulnerable to natural disasters. The region is mountainous, containing a dense waterway network of rivers and canals where heavy rainfall can lead to transportation disruptions. There are many mountain roads posing difficulties for the movement of heavy equipment, with few alternative routes in the event of blockage. On Taiwan, the natural environment along the west coast creates complex conditions for landing troops and materiel. Most beaches have difficult composition including mudflats with shallow water. On the west coast, ebb tides can leave 200 m of mudflats. Forces and supplies are required to land during a short timeframe. In the Taiwan Strait, strong winds and high sea state persist for 8-9 months, typhoons develop during half of the year, and there are northeast monsoons for 3 or 4 months. Ships unloading without a wharf can easily become stranded. Currents mostly run parallel to the coast and can cause landing ships and craft to miss their intended landing site and strike underwater obstacles. Fog, which occurs more than 10 days per month, can help conceal the landing force but can also increase the difficulty of maintaining formations and landing waves in large-scale landings. The PLA assesses that there are many landing areas on Taiwan, but the complex beach, meteorological, and hydrological conditions combined with Taiwan's defenses create difficulties for landing troops, equipment, and supplies. [21]

The joint landing and logistics forces require strategic mobility to deploy forces to embarkation areas and across the strait for the landing and on-island operations. Deployment will require large-scale air, road and rail, and water transportation from multiple directions in multiple echelons from the strategic rear area to the coast and to Taiwan. Secondary fronts will also require transportation

[20] *Operational Logistics Support*, 98-99, 169-170.

[21] Ibid., 94-95, 137; Chen et al, "Problems and Countermeasures of Sea Crossing and Landing Transportation Service Support," 166-169.

support in the event of chain reactions. In 2017, the PLA assessed its military transportation force as weak and its infrastructure as vulnerable.[22]

Maritime Delivery

Sea lift will be the primary link in the logistics chain by which the largest volume of forces and materiel will be transported across the strait. This section will examine elements and issues identified by PLA logistics studies concerning the PLA's ability to leverage maritime transport resources, focusing heavily on civil transport.

Operational Logistics Support assesses that the first echelon force and likely the second echelon will need to conduct "shore-to-shore" (岸到岸) landings directly onto the beach, augmented by lightering. This source assesses that the first echelon force will land primarily by amphibious landing ships, air cushion vehicles, fishing boats, and other landing craft, augmented by civilian ships converted to landing ships.[23]

The PLA believes that civilian semi-submersible transport vessels could support the landing of amphibious equipment. The PLA has also used semi-submersibles as platforms for Army Aviation. The ships' large flat deck can carry amphibious vehicles and air cushion landing craft for unloading at sea. Semi-submersibles as well as other suitable civilian ships carrying fuel supplies could use floating or underwater pipelines to pump fuel to the shore. A new stern ramp for a roll-on/roll-off (RO/RO) ship has been observed capable of launch and recovery of amphibious armored vehicles supplementing the landing of forces.[24]

A PLA source recommends developing the capability to unload containers without a terminal. This includes the development of auxiliary crane ships and specialized unloading and transport equipment to allow the unloading of containers without a terminal or wharf. This would primarily support the logistics build up after a logistics forward support base is established.[25]

The PLA assesses that the civil fleet lacks the capabilities for amphibious force delivery and equipment and materiel unloading without a wharf, at sea roll-off, hoisting and load change, and sea-to-shore large-scale pipeline discharge. The PLA does intend to refit civilian ships to support the assault landing, including transforming civilian ships into landing ships. In addition, active or reserve specialized technical personnel would need to supplement the civilian crews; however, according to a 2014 article, the PLA assesses specialized reserve personnel are too few.[26]

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[22] *Operational Logistics Support*, 169-170.

[23] Ibid., 120.

[24] 刘刚 [Liu Gang], 我国半潜式运输船动员需求及能力展望 ["Prospect and Demand for Mobilization of Semi-submersible Carriers in China"], 国防交通工程与技术 [*National Defense Transportation Engineering and Technology*], no. 3 (2015), 1-3; " Multi-Type Helicopters Conduct Deck-Landing Training on Civilian Semi-Submersible Vessel," *China Military Online*, August 21, 2020, http://eng.chinamil.com.cn/view/2020-08/21/content_9887106.htm; Conor Kennedy, "Ramping the Strait: Quick and Dirty Solutions to Boost Amphibious Lift," *China Brief* 21, no. 13 (July 16, 2021), https://jamestown.org/program/ramping-the-strait-quick-and-dirty-solutions-to-boost-amphibious-lift/.

[25]刘宝新，袁沐 [Liu Baoxin and Yuan Mu], 基于 SWOT 分析的军事装备水路集装箱运输发展策略研究 ["Research on the Development Countermeasures of Military Equipment in Waterway Container Transportation Based on SWOT Analysis Method"], 物流科技 [*Logistics Sci-Tech*], no.7 (2018), 134-136.

[26]刘刚，虞鹏程 [Liu Gang and Yu Pengcheng], 关于组建快速动员海运力量的思考 ["Our Reflection on the Quick Organization of Military Sealift Reserve Forces"], 国防交通工程与技术 [*National Defense Transportation Engineering and Technology*], no. 3 (2014), 3.

Civilian Maritime Strategic Projection Support Fleet

The PLA can mobilize large and medium state-owned civil shipping enterprises to deliver forces and provide logistics support. There are two methods of civilian ship mobilization: agreement mobilization is employed to mobilize civilian ships for non-war maritime support missions; compulsory requisition is employed in an emergency to mobilize civilian ships into the active force as reserves. China established the first national maritime strategic projection support fleet in October 2012, based on the China Shipping Group (now merged with COSCO). The joint logistics force has identified civilian ships built to military specification for mobilization.[27]

The strategic projection support fleet is a component of the national strategic projection support force. It is a reserve component formed from large shipping enterprises—China COSCO Shipping, Hainan Strait Shipping Company, China National Offshore Oil Corporation, and China Shipbuilding Industry Corporation, for example—responsible primarily for force transport and logistics support. They are formed into a three-tier structure, including "general corps" (总队), "groups" (大队), and "squadrons" (中队). The civilian fleet is also required to support offshore and open sea offensive and defensive operations.[28]

Exhibit 3. The PLA employs civilian ships to transport heavy equipment.[29]

[27]Ibid., 2-3; 无锡联勤保障中心积极做好新下水半潜船"民参军"各项工作 ["Wuxi Joint Logistic Support Center Actively Completes the Work of 'People's Participation in the Army' for Newly Launched Semi-Submersible Ships"], 中国军网 [*China Military Online*], April 16, 2017, http://www.81.cn/jfjbmap/content/2017-04/16/content_174964.htm.

[28]何国本，邹伟，陈龙，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*] 19, no. 5 (May 2017), 1-4; 梁峰，李政硕，宗福兴，于力，黄炳豪 [Liang Feng， Li Zhengshuo, Zong Fuxing, Yu Li, and Huang Binghao], 关于我军海上预置能力建设的思考 ["Thoughts on the Construction of Our Army's Maritime Pre-positioning Capability"], 军事交通学院学报 [*Journal of Military Transportation University]*, 20 no. 6 (June 2018), 48-49.

[29] 解放军征用民船送运战车坦克群 ["The PLA Requisitions Civilian Vessels to Transport Combat Vehicles and Tanks"], 中国军网 [*China Military Online*], July 13, 2015, https://mil.huanqiu.com/gallery/9CaKrnQhhsH.

PLA experts noted in 2017 that the civilian shipping force needs improved training for wartime operations and training assessment standards to ensure the overall quality of the civilian force. They complain that commercial enterprises are focused more on business than military related training and have not established the training required under the National Defense Transportation Law to support military operations. They have not created training organizations with designated personnel to formulate training requirements and plans, resulting in civilian crews without the skills required to operate under combat conditions. The PLA has made proposals to improve training organization with military training supervision and guidance for the strategic projection support fleet, including annual assessments of the civilian fleet to improve quality and the establishment of a training department at the general corps, a training section at the group, and a training group at squadron levels to ensure training requirements are met.[30] However, it is unknown whether any proposals have been implemented. PLA sources also recommend that the PLAN increase training with mobilized civilian shipping on logistics support and wartime operations. Most civilian ship training with the military involves one or two ships, inadequate to meet requirements for a large-scale landing operation.[31]

Exhibit 4 lists possible missions for civilian ships in support of the PLA. Civilian ships require modifications including deployment of specialized military communications equipment; living areas for military personnel augmentation; medical facilities; improvements to ship structure and performance such as reinforcing decks or preparing helicopter landing sites; and firefighting and rescue equipment. PLA sources assess some modifications could be relatively easy while others would be extensive.[32]

[30] He et al, "Current Situation and Countermeasures of Strategic Projection Support Fleet Training," 1-4.

[31] Liu and Yu, "Our Reflection on the Quick Organization of Military Sealift Reserve Forces," 4.

[32]王和文 [Wang Hewen], 新形势下推动民船贯彻国防要求体系发展的思考 ["Thoughts on Promoting Development of Civilian Ship Carrying Out National Defense Requirements Under New Situation"], 军事交通学院学报 [*Journal of Military Transportation University*] 17, no. 11 (November 2015), 22-26.

Exhibit 4. Possible Missions of Civilian Ships in Support of the PLA[33]

Mission Purpose	Support Task	Applicable Ship Type
Transportation and Delivery	Conduct joint implementation of troop, equipment, and materiel supply transportation support	Passenger RO/RO ships or vehicle RO/RO ships, multi-purpose ships, container ships, bulk cargo ships, general cargo ships, oil tankers
	Landing and unloading support for organic units	Semi-submersible barges (ships) or heavy cargo carriers, multi-purpose ships or bulk carriers, deck barges, tugboats
At Sea Replenishment	Dry and liquid replenishment as a supplement to comprehensive supply ships	Oil tankers, multipurpose or container ships
Medical Support	Implement rescue and transfer of patients, early treatment and evacuation support for large numbers of patients as a supplement to the standard medical service equipment	Passenger RO/RO ships (refitted as health transport ships), container ships (refitted as hospital ships), high-speed passenger ships and motorized marine fishing vessels (refitted for rescue), rescue/salvage boats
Engineering Support	Assist in port and wharf repair, channel dredging and obstacle clearing, etc. as a supplement to military auxiliary ships	Tugboats, deck barges, salvage boats
Equipment Technical Support	Implement maintenance, towing and other equipment technical support for ship repair, as well as helicopter relay support, etc.	Tugs, semi-submersibles (barges) or heavy cargo carriers, crane boats
Safeguard Maritime Interests	Participation in protecting maritime rights and other support operations	Motorized marine fishing vessels

Air Delivery

The PLAAF is fielding and developing larger transport aircraft to support strategic delivery. Air transport can deliver supplies and personnel over great distances more rapidly than other methods, but in smaller quantities. The Army Aviation force is expanding as well, with new transport helicopters fielded and a heavy lift helicopter planned to increase delivery capabilities. The Y-20 medium transport entered military service in 2016 and can reportedly carry the 58-ton Type 99A2 main battle tank. PRC press reports speculate that the Air Force will eventually receive 100 to 400 or more Y-20s. Large numbers of this or future large transport aircraft are required if the PLA plans on a significant capability to airlift supplies and forces on Taiwan.[34]

[33] Ibid., 23.

[34] "Chinese Air Force completes first flight of large transporter ," Xinhua, July 7, 2016, http://news.xinhuanet.com/english/2016-07/07/c_135496198.htm; "Xian Y-20 cargo plane has set new records: designer," WantChinaTimes, March 5, 2014, http://www.wantchinatimes.com/news-subclass-cnt.aspx?id=20140305000135&cid=1101; Zhao Lei, "Y-20 Gives Air Power Push," *China Daily*, January 28, 2013, http://usa.chinadaily.com.cn/epaper/2013-01/28/content_16180440.htm; Zhao Tao, "Heavy-duty Y-20 Military Airlifter Weighs in at Show," *China Daily USA*, January 28, 2013, http://eng.mod.gov.cn/DefenseNews/2014-

The PLAAF has studied the U.S. military's use of unmanned vehicles and precision air delivery to provide logistics support in Afghanistan.[35] In 2017, the PLAAF began experimenting with delivering supplies to remote units with unmanned aerial vehicles (UAVs). The PLAAF Logistic Department partnered with the civilian company SF Express to use a medium-size drone to provide supplies by parachute. The PLAAF viewed this experiment as part of the intelligent battlefield revolution.[36] Unmanned vehicles (UV) could provide future emergency logistics to isolated units in Taiwan. As larger capacity UVs are developed and deployed they could become an important method for providing support to the assault landing force.

Exhibit 5. PLAN logistics personnel load materiel on a UAV.[37]

Civilian Airline Strategic Projection Support Fleet

The civil air fleet reserve force is an important resource to augment the PLAAF's current limited strategic projection capabilities. In 2011, the CMC incorporated the establishment of a strategic projection reserve force into the 12th Five-Year Plan. The PRC began creating a civil aviation strategic projection support fleet in 2013. This force was initially based in China Southern Airlines

11/13/content_4550942.htm; Zhao Lei, "Transport Planes Boost PLA Capabilities," *China Daily*, December 20, 2017, http://usa.chinadaily.com.cn/a/201712/20/WS5a39a438a31008cf16da24a8.html; "China, Russia Progress in Talks to Produce Heavy-Lift Helicopters," *Global Times*, September 14, 2017, http://www.globaltimes.cn/content/1066343.shtml; see also Cristina L. Garafola and Timothy R. Heath, "The Chinese Air Force's First Steps Toward Becoming an Expeditionary Air Force," RAND Corporation, March 2017, www.rand.org/pubs/research_reports/RR2056.html.

[35]赵先刚 [Zhao Xiangang], 打通保障链"最后一公里" ["Open the 'Last Mile' of the Support Chain"], 中国军网 [*China Military Online*], October 15, 2019, http://www.81.cn/jfjbmap/content/2019-10/15/content_245287.htm.

[36]张汨汨，冯国宝 [Zhang Mimi and Feng Guobao], 我军首次运用无人机实施联合补给演练" ["Our Army Uses UAVs for the First Joint Supply Exercise"], 中国军网 [*China Military Online*], January 27, 2018, http://www.81.cn/jwgz/2018-01/27/content_7923080.htm.

[37] "PLA Naval Brigade Conducts UAV Delivery Training," *China Military Online*, December 22, 2020, http://eng.mod.gov.cn/news/2020-12/22/content_4875921.htm.

and China Eastern Airlines but later included other air transport enterprises. Currently there are 15 civil support fleets based in major airlines to meet increasing requirements for overseas non-war and wartime operations. The civilian airline strategic projection support fleet has supported evacuations from Libya and international disaster relief operations such as the Indian Ocean tsunami and earthquakes in Haiti and Chile.[38]

The civilian airline strategic projection support fleets include passenger and cargo aircraft. Exhibit 6 shows the PRC's current civilian passenger aircraft numbers by airline. According to PLA experts, as of 2019 the PRC had 143 large and medium civilian cargo aircraft that would meet PLA standards for strategic projection. These have a total payload of 6,200 tons and include sixty 737, thirty 757, and twenty-six 777 Boeing cargo aircraft. The indigenous C919 airliner primarily intended for passengers reportedly will constitute a large proportion of the future civil air fleet.[39]

Exhibit 6. Current Major Civilian Airlines and Passenger Aircraft Inventory

Airline Company	**Aircraft**
Air China	662
China Southern	786
China Eastern	642
Hainan Airlines	740
Xiamen Air	116
Shenzhen Airlines	116
Sichuan Airlines	130

Ground Transportation

Rail and road are the main methods for deploying the assault landing force and supplies to embarkation areas. Air and waterway transport will supplement ground transportation to the coast. Ground transportation will rely on rail for longer distances and the transportation of tracked vehicles, with road transportation for shorter distances and the movement of wheeled vehicles. Large numbers of forces and materiel will require transportation not only within the warzone (i.e., the Eastern and Southern Theater Commands), but also from the Northern and Central Theaters to the southeast coast. The PLA estimates that tens of millions of tons of equipment and supplies will be transported

[38] 张昕，苑德春，张超 [Zhang Xin, Yuan Dechun, and Zhang Chao], 依托战略投送支援机队实施海外航空战略投送 ["Overseas Aviation Strategic Projection Using Strategic Projection Support Fleet"], 军事交通学院学报 [*Journal of Military Transportation University*] 20, no. 4 (April 2018), 5-7, 12; 孙振岚，海军 [Sun Zhenlan and Hai Jun], 我国民航运输业建设现状与未来发展 ["On the Present Situation and the Future Development of the Construction of Civilian Aviation Transportation in China"], 国防交通工程与技术 [*National Defense Traffic Engineering and Technology*] 17, no. 1 (January 2019), 1.

[39] Sun and Hai, "On the Present Situation and the Future Development of the Construction of Civilian Aviation Transportation in China," 1-3.

to the southeast coast. The PLA assesses that 40 percent of rail capacity will be used for the operation and in special cases up to 60 percent of rail capacity may be used.[40]

Exhibit 7. Rail movement of PLA equipment.[41]

Heavy equipment transporters (HET) are an important transport asset. Subordinate to the Joint Logistic Support Force and the Army, HET units provide strategic delivery of heavy and tracked equipment. These transport brigades and regiments, as well as mobilized civilian equipment, are becoming increasingly important as the PLA mechanizes. Employment of these transportation units requires coordination between multiple military and civilian departments. The PLA inventory includes an unknown number of HETs.[42] The PLA also fields a large albeit unknown number of motor transport brigades and regiments for strategic delivery by road.[43]

[40] *Operational Logistics Support*, 109, 115.

[41] 周寅，黄云焜，徐胜 [Zhou Yin, Huang Yunkun, and Xu Sheng], 误差不超 2 厘米，战车铁路输送的秘籍原来是这样 [“An Error Not Exceeding Two Centimeters, The Secret to Railway Transportation of Military Vehicles”], 中国军网 [*China Military Online*], July 10, 2018, http://photo.81.cn/jypk/2018-07/10/content_8084888.htm.

[42] 我军首支重装备运输部队亮相 “大家伙”这样上高原组图 [“The First Heavy Equipment Transportation Unit of Our Army Appears on the Plateau like "Big Guy"’], 中国军网 [*China Military Online*], December 27, 2016, http://photo.81.cn/pla/2016-12/27/content_7425199.htm.

[43] 磨砺能打胜仗的通途劲旅 [“Thoroughfare Strong Brigade Grinding Can Win the War”], 中国军网 [*China Military Online*], September 2, 2019, http://www.81.cn/jfjbmap/content/2019-09/02/content_242319.htm; 任杰，李勤真，刘海英 [Ren Jie, Li Qinzhen, and Liu Haiying], 军民融合履带式重装备公路运输力量建设 [“Construction of Road Transportation Force for Tracked Heavy Equipment in Conditions of Civil Military Integration”], 军事交通学院学报 [*Journal of Military Transportation University*] 17, no. 6 (June 2015), 11-13, 40; 王春刚，洪梅，姚中坚 [Wang Chungang, Hong Mei, and Yao Zhongjian], 提高陆军重装备公路运输力量运用效能的思考 [“Thoughts on Improving

Large numbers of civilian HETs would need to be mobilized for wartime employment. Civilian enterprises contain large numbers of HETs, but many including newly-produced vehicles do not meet military requirements for movement of armor. Civilian HETs are not evenly distributed throughout the PRC; however, they are concentrated in eastern and southern coastal regions where they can support the movement of armor to embarkation areas. To make them suitable for military use, semi-trailers often require modification by the receiving unit. PLA sources assess the current vehicle mobilization system as immature. The PLA assesses that the current numbers of military and civilian HETs are insufficient to support emergency requirements.[44]

Delivery Support During the Various Operational Stages

The joint landing operations can include the following stages: operational preparation, preliminary operations, maritime transit and assault landing, and on-island operations. Each poses different logistics requirements for delivery of forces and materiel.

Operational Preparation Stage

The main task in the operational preparation stage is to deliver troops to assembly areas, operational positions, and embarkation areas on time. The length of this stage depends on transportation capabilities and the forces and materiel transported. Logistics missions during this stage include supporting the deployment of the PLAAF and PLARF conventional missile units to implement combat operations; transporting the landing force to embarkation areas; ensuring the adjustment and transportation of joint logistics forces and completing the movement of the required military supplies, POL, ammunition, medical supplies, and other combat materiel reserves; mobilizing civilian transport, especially shipping, and completing the refitting of ships to support landing operations; and completing the camouflage and protection of key transportation targets and preparing for rush repair. Mobilization, requisitioning, and refitting of civilian ships take a long time and must begin in advance. These logistics missions could provide indications and warning of the impending operation early in the preparation stage.[45]

Mobilizing and refitting civilian ships to make up for the shortfall in amphibious lift takes time, depending on the amount of modifications. While the PRC has a significant number of civilian ships, they require difficult refitting and crew training to support the delivery of the amphibious landing

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Use Efficiency of Army Heavy Equipment Road Transport Capacity"], 军事交通学院学报 [*Journal of Military Transportation University*] 21, no. 11 (November 2019), 5-8.

[44] Problems with vehicle mobilization include the following: a National Defense Mobilization Department is established but civilian organizations at the local levels are inadequate for the task; the mobilization information system requires greater integration between the military and civilian networks as well as improvements in civilian information systems; there exists no comprehensive database to track civilian vehicle and equipment resources for precision mobilization; inadequate civilian training with the military; poor communications interoperability between HET units and supported units; and the occasional unavailability of the Beidou satellite navigation and the dynamic monitoring system of the transportation units, hindering operations. It is unknown if these problems are being addressed. 王仙凤，吴克华 [Wang Xianfeng and Wu Kehua], 军民融合战略下车辆装备保障力量动员问题探析 ["Vehicle Equipment Support Force Mobilization Under Civil-military Integration Strategy"], 军事交通学院学报 [*Journal of Military Transportation University*] 19, no. 5 (May 2017), 28-31, 60; 李勤真，王宁，刘海英 [Li Qinzhen, Wang Ning, and Liu Haiying], 基于军民融合的重装备战略投送公路支援车队建设研究 ["Research on Construction of Heavy Equipment Strategic Delivery Highway Support Fleet Based on Civil Military Integration"], 物流科技 [*Logistics Technology*], no. 1 (2019), 152-155; Wang et al, "Thoughts on Improving Use Efficiency of Army Heavy Equipment Road Transport Capacity," 5-8; "磨砺能打胜仗的通途劲旅" ["Thoroughfare Strong Brigade Grinding Can Win the War"], 中国军网 [*China Military Online*], September 2, 2019, www.81.cn/jfjbmap/content/2019-09/02/content_242319.htm; Ren et al, "Construction of Road Transportation Force for Tracked Heavy Equipment in Conditions of Civil Military Integration," 11-13, 40.

[45] *Operational Logistics Support*, 97-99.

force. The lack of uniformity and availability of civilian ships adds to the problem of refitting them for amphibious operations.[46]

Preliminary Stage

The preliminary stage includes military deterrence, joint fire strike, and blockade operations. The blockade could last several months as an independent operation or for a relatively short time as part of the joint landing campaign. When the joint landing campaign is conducted, most of the forces and materiel will have already been transported to the coast. The PLA assesses that if the U.S. intervenes, strikes will be conducted against PRC military targets, large and medium cities, important transportation hubs, ports, airports, tunnels, and bridges. Repair forces will be mobilized to support the delivery of the remaining forces on schedule. Defensive measures and camouflage and concealment will be employed to safeguard transportation nodes, ports, airfields, and embarkation areas. Civilian ships will be dispersed and concealed for protection.[47]

Multiple methods and locations will be employed for embarkation to disperse and protect the loading operation. Embarkation will employ large and small ports, military and civilian ports, ocean and river ports, and fixed and temporary embarkation points.[48]

Sea Crossing and Landing Stage

The sea crossing and landing stage is the key to the entire joint landing. Air, maritime, and information superiority are critical for a successful transit and assault landing. According to PLA experts, air and maritime supremacy should be 100 percent against Taiwan, and if the U.S. intervenes the PLA should achieve 60-70 percent air and maritime supremacy in the area of operations to adequately protect transiting forces. The PLA identifies four stages of the transit and assault landing delivery: sea crossing preparation; embarkation; sea crossing; and unloading and landing.[49]

The sea crossing preparation stage begins during the operational preparation stage. The mobilization and refitting of civilian ships will have been completed. When the objectives of the blockade and joint fire strike operations are achieved, the transportation and delivery command will establish a joint embarkation command post to command the embarkation command posts for each embarkation area. This joint embarkation command post will organize repairs of ports and wharves; prepare troop assembly and loading areas; add defensive systems and communications equipment to the civilian ships; and prepare cranes, loading equipment, and temporary wharves to support embarkation.[50]

The embarkation stage links up transport ships and units at the dispersed embarkation points for loading. Each campaign formation—a Group Army-size task force—will have an embarkation area that is subdivided into brigade embarkation zones and battalion level embarkation points. A sea standby area will be designated for assembly of shipping. The PLA recommends that embarkation be concealed by, for example, loading at night. Close coordination is necessary between the embarkation command post, the PLAAF, PLAN, and ground air defense forces to maintain an effective air raid early warning system. Loading and unloading for each landing direction, echelon and group must be carefully coordinated with the use of returning ships to evacuate wounded.[51]

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[46] Ibid., 170.

[47] Ibid., 99-100.

[48] Ibid., 119-120.

[49] Ibid., 99.

[50] Ibid., 100-101.

[51] Ibid., 101.

The sea crossing stage requires close coordination between the PLAN and civilian ship formations. The transportation and delivery headquarters coordinates with the PLAN in organizing the civilian ship formation. The Amphibious Task Force's Transport Group commands the transport ships during the transit. The PLAN, PLANAF, and PLARF will be responsible for underwater, surface, and air surveillance, and they will provide cover for the transport formations during navigation. The PLA will open a secure transit corridor to the designated landing beaches to maintain air and maritime superiority over the transport formations and eliminate any threat to them. The difference in speed of the civilian ships will require careful planning to regulate the correct arrival of the various landing waves.[52]

The unloading and landing stage is the most difficult and intense stage, requiring efficient and rapid landing to reduce casualties and build up combat power on the beach to seize a landing base for the second echelon. PLA experts assess that all the first echelon and most of the second echelon will unload and land without ports. Civilian ships converted into landing ships will unload at the beach with amphibious assault ships and craft, while other civilian ships will unload at offshore platforms or temporary wharves once constructed. Landing of second echelon forces will be conducted immediately on beaches where the initial assault force has achieved a successful landing. Follow-on force landings will require flexibility to adjust their landing areas when the initial assault landing is slowed or blocked to avoid congestion and reduce casualties. This will require flexible logistics command and coordination to redirect logistics support based on changing situations. If possible, second echelon and reserve forces will land on constructed temporary wharves or functioning captured ports. The various landing directions, landing ship groups, sub-directions, echelons, and landing waves will require close coordination with the offshore unloading command of the Unloading Support Group. The transportation and delivery command will be mainly responsible for installing offshore transfer platforms and establishing a technical support team composed of waterway military representative offices, local shipping companies, technical support detachments, and port shipping departments to assist in organizing the lightering of forces from the platforms to the beaches.[53]

Campaign logistics support forces will be responsible for the unloading of materiel, equipment, POL, and other means of support for the assault force. Logistics units will land behind first echelon brigades. Landing times will be short due to tides and hydrology in the area impacting the ability to resupply the initial assault force. The PLA expects Taiwan's ports to be heavily defended, prepared for destruction, and within range of enemy fire support, requiring that initial logistics support be conducted over-the-shore. When ports are seized, repairs are expected to be lengthy. PLA experts have carefully studied the construction of Mulberry Harbors to support the Normandy invasion. They find that multiple and flexible unloading methods would be required to build up the necessary forces on Taiwan. Several methods for landing logistics at the landing site are proposed, including the following: [54]

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[52] Ibid., 101;黄炳越，吴晓锋，周智超 [Huang Bingyue, Wu Xiaofeng, and Zhou Zhichao], eds, 两栖作战编队指挥体系研究 [*Research on Amphibious Operations Formation Command System of Systems*], (Beijing: Military Science Press, 2013), 56.

[53] Ibid., 101-103.

[54] Ibid., 203-204; 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), 15-18; Chen et al, "Problems and Countermeasures of Sea Crossing and Landing Transportation Service Support," 166-169.

- Airdrop of supplies using informationized technology employing positioning systems and controllable parachutes for precision airdrops. The PLA states that fuel bladders, medical equipment, and other materiel can be airdropped, including the use of pallets.[55]

- Vertical landing of troops, equipment, and supplies by helicopter can provide urgent reinforcement.

- Air cushion vehicles can directly land personnel and materiel on beaches unsuitable for other landing methods.

- Construction of wharves and ramps for RO/RO ships can provide a relatively high volume means of unloading personnel and materiel, although they would be vulnerable to enemy fire strikes. Construction of wharves and exit roads from the beaches is considered difficult. Small fishing ports can be used for unloading light equipment and small quantities of supplies once obstacles are removed and a wharf constructed.

- Pipelines have a high capacity to deliver fuel and fresh water from ship to shore. The PLA has high volume pipelines with short deployment times.[56]

On-Island Combat Stage

During the on-island combat stage, the joint logistics command organization will organize transportation within Taiwan. This includes constructing an unloading base composed of a temporary harbor and repairing damaged enemy ports. Motor transport units will supply and transport forces conducting operations in Taiwan. Field medical units will treat wounded and evacuate them to the logistics base, and back to rear hospitals. The campaign transport and delivery command will organize air and sea transport to and from Taiwan during this stage.[57]

Quickly establishing a logistics forward support base in the main landing direction is critical for creating an on-island support capability that is connected to maritime and air support assets. Enemy fire strikes and counterattacks pose serious threats to establishing a forward support base. According to PLA experts, establishment of the support base will begin approximately two hours after the landing of the first echelon of the first echelon campaign formation. The unloading force should be deployed within six hours to support unloading of the heavy equipment of the second echelon. The base should be set up in a dispersed manner to provide greater survivability since protection capabilities are weak during the initial stage of the landing. The support base will include a command information system, materiel unloading systems, and a rear support system with rescue, transport, repair, and other critical functions. The support base will conduct the following missions:[58]

- Remove remaining obstacles in coastal waters, beaches, and on land; set up navigation aids, open channels to the beaches, and organize and adjust logistics support.

[55] *Operational Logistics Support*, 205-207.

[56] Ibid.

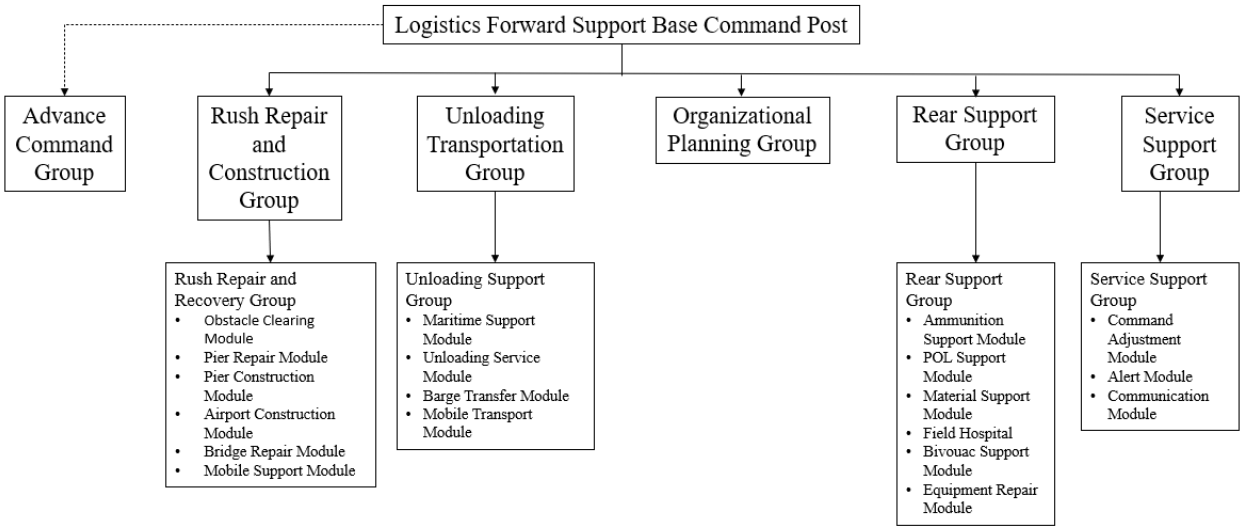
[57] Ibid., 103.

[58] Ibid., 204-205, 218; 汪欣，王广东 [Wang Xin and Wang Guangdong], 运输投送力量在跨海登岛作战登陆 ["Transport Delivery Force in a Cross Sea Landing Operation"], 国防交通工程与技术 [*National Defense Transportation Engineering and Technology*], no. 5 (September 17, 2019), 12-16.

- Construct and maintain transfer platforms and wharves, and repair or construct landing fields for fixed and rotary wing aircraft.
- Organize the unloading of follow-on troops, heavy equipment, and materiel.
- Establish service stations to provide food and accommodation for transiting troops.
- Organize equipment maintenance and repair.
- Organize an alert system and deploy ground air defenses to protect the support base.

The command organization of the logistics forward support base will likely be located with the rear command post of the first echelon campaign formation. The commander will be the deputy commander of the rear command post and the command will be augmented with additional personnel. The command organization will be mainly responsible for planning and preparation, force projection, base establishment and management, advance surveying, coordination of unloading, and various logistics services. Exhibit 8 shows the support base command organization.[59]

Exhibit 8. Logistics Forward Support Base Command Organization and Force Formation



Subordinate groups of the logistics forward support base will comprise modular logistics forces reinforced with PLA Army (PLAA) and PLAN operational forces. Modular teams will be capable of recombination according to the required scale and changing requirements. The logistics forward support base command will include the following groups, with each group composed of subordinate specialized modules:[60]

- The advance command group will probably be commanded by the base deputy commander, military transportation personnel, and others as needed. The advance command group will land with the first echelon brigades and be responsible for conducting base topographic

[59] *Operational Logistics Support*, 205-207.

[60] Ibid., 207-209; Wang and Wang, "Transport Delivery Force in a Cross Sea Landing Operation," 12-16.

survey and site selection, organizing advance troops to repair or construct wharves, and preparing for transportation service.

- The rush repair and construction group will include PLAA engineers, naval and civilian port personnel, PLAAF, and other specialized and technical personnel responsible for organizing and guiding the emergency repair and construction of docks, airports, roads, and other required infrastructure. Subordinate modules will include land and sea obstacle removal, wharf emergency repair, wharf emergency construction, airport construction, road and bridge repair, and movement support modules responsible for opening and maintaining transportation infrastructure.

- The unloading transport group will comprise combat service, military transportation, mobilization departments, and relevant civilian personnel responsible for scheduling, coordinating, and organizing loading and unloading at ports, temporary wharves, and airports. Subordinate modules will include maritime support, unloading service, transfer, and mobile transportation modules responsible for the movement of heavy equipment and materiel onto and around the island.

- The rear support group will serve as the campaign logistics forward support force, opening field stations and implementing base support for the landing forces. The rear support group will include the multi-functional theater joint logistics support brigades or field service stations, which will provide resupply and early medical treatment, and other modules including ammunition, POL, materiel, field hospitals, equipment repair, food, and shelter to support troops in the field.

- The service support group will be responsible for the field command and communications structure, adjusting the unloading, lightering, and transfer of maritime, ground, and air transportation, and organizing maritime, ground, and air alert and defense. Subordinate modules will include the command adjustment, alert, and communication support modules responsible for command adjustment of maritime and land transfer, unloading, maneuver, and other operations of the campaign logistics force.

Modular logistics units will provide dispersed multi-point deployment to support forward operational units, all connected by the command information system. Reserves will be formed, including a rear reserve, prepositioned reserve, and mobile reserve. Logistics manpower, equipment and materiel resources, allocation areas, and command locations will be flexibly adjusted according to changing battlefield situations and operational stages to enable continued and stable logistics support. A strong and survivable command information system is critical to maintain command, control, and coordination of dispersed forces on a dynamic battlefield. The command information system will include wired, wireless, satellite, data link, and other communications means. Multiple redundant nodes will ensure the survivability and continuous operation of the network. The logistics command network will be connected to the operational command information system to maintain coordination with operational units.[61]

The logistics forward support base is critical to the success of the landing operation and requires robust defenses. In addition to reliance on the campaign-level defensive system, the support base also will require the integration of its own defense assets into a regional defense system. Logistics self-defense assets will be deployed based on the nature of the enemy threat and concentrated near high

[61] *Operational Logistics Support*, 210-211.

value targets such as command posts, concentrations of supplies and equipment, and the transportation system. Various cover and concealment methods will be employed to improve the survivability of the support base and logistics units, including camouflage, natural shelter, terrain, vegetation, and civilian buildings. Measures also include anti-reconnaissance means to protect equipment from enemy optical and radar reconnaissance, decoys and false targets such as false radio networks, and protective field defensive positions.[62]

Unloading Operations

As mentioned previously, the ability of the PLA to offload large volumes of forces and materiel to reinforce landing zones will be crucial to the overall success of a cross-strait landing campaign. Without it, combat forces already ashore could experience incredible losses. This section will explore in-depth how the PLA intends to deliver critical follow-on forces and supplies.

The PLA believes that it will need to employ multiple methods to land troops, equipment, and materiel. PLA experts discuss various methods for seizing a port but assess that seizing a usable port is unlikely. They believe that Taiwan will defend its ports, destroy critical infrastructure such as cranes, lay land and sea mines, emplace obstacles, scuttle ships at entrances to ports and at wharves, sink containers full of rocks as obstacles, and set flame devices. The PLA will seize ports during the landing operation, but restoring destroyed ports requires an intensive repair and construction effort employing large numbers of personnel and large quantities of materiel, and time. Only parts of destroyed ports need to be restored initially, although this would include clearing port entrances, removing dockside obstructions, and placing navigation aids. RO/RO ships would only need a suitable gangway for unloading. Roads and bridges leading out of the captured port would require repair to support movement from the port area.[63]

Anticipating limited access to Taiwan's ports initially, the PLA has conducted research on equipment for unloading large quantities of materiel and heavy equipment over the shore. Delivering equipment and supplies across Taiwan's beaches will be difficult due to the defenses and obstacles, potential adverse weather, and natural beach conditions featuring mudflats and soft beach terrain. Civilian unloading equipment capacity is large and can be mobilized along the southeast coast to support this effort. This equipment includes self-propelled floating crane platforms and vessels which can be moored with engineering barges to form transfer platforms at sea. These transfer platforms can be used to transfer forces and supplies from civilian ships to the platform and lightering to the shore. Transfer platforms can also be used to support the construction of artificial floating wharves or repair damaged wharves. Truck mounted and tracked cranes can be used to unload civilian ships. Bridge or gantry cranes can be transported by special ships to replace damaged cranes in ports. There is little evidence of the PLA training to carry out construction and unloading using floating platforms and temporary wharves under combat conditions. Training realism will be important as these unloading options are vulnerable to enemy firepower, weather, and sea conditions.[64] To solve the challenges of

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[62] Ibid., 221-223; Chen et al, "Problems and Countermeasures of Sea Crossing and Landing Transportation Service Support," 166-169; 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 ["Discussion on Several Problems of Military Transportation Support in Landing Operations"], 国防交通工程与技术 [*National Defense Transportation Engineering and Technology*], no. 1 (2005), 1-5.

[63] *Operational Logistics Support*,213; Chen and Li, "Discussion on Several Problems of Military Transportation Support in Landing Operations," 1-5; Wang and Wang, "Transport Delivery Force in a Cross Sea Landing Operation," 12-16.

[64] *Operational Logistics Support*, 212-214; 王果，王志斌，刘靖峤，翁欢英 [Wang Guo, Wang Zhibin, Liu Jingqiao, and Weng Huanying], 两栖登陆作战后勤保障研究 ["Research on Logistics Support for Amphibious Landing Operations"], 船舶 [*Ship & Boat*], no. 4 (2019), 108-114; Chen and Li, "Discussion on Several Problems of Military

over-the-shore logistics support, the PLA could employ artificial floating wharves, beach unloading platforms, or maritime barge transfer platforms. Airlanding of troops and materiel can also augment the buildup of forces on Taiwan.

Artificial Floating Wharf

An artificial floating wharf landing area would include a pier for unloading RO/RO ships and a pier with cranes for unloading cargo ships in a protected estuary or coastal area. When constructed on the coast, they would need breakwaters to prevent or dissipate waves and minimize the impact of wind and tide. The PLA assesses that it can quickly construct artificial floating wharves to provide an effective means of rapid unloading. Around 2014, the PLA experimented with two 5000-ton trestle wharves to construct two temporary piers to unload one armored regiment and an artillery regiment in one tide period. Multi-purpose pontoons, floating wharves and floating cranes, engineering barges, semi-submersibles, PLAA bridging equipment and road mat-layers, and other specialized equipment could be used to set up the floating wharf and provide access to and exit from the beach. Wind, waves, tides, beach topography, geological conditions, and natural or artificial obstacles existing on the Taiwan coast would add to the difficulty of choosing the correct location for the floating wharf.[65]

Beach Unloading Platform

Similar to the floating wharf concept, a beach unloading platform could be used to unload RO/RO ships. Floating or elevated trestle systems with tracked unloading systems or PLAA bridging equipment can provide access to the beach. A location would be selected based on the natural and artificial environment. A coastal area with relatively steep topography would be required to enable the berthing of large ships, and a breakwater system would be required to protect the unloading platform.[66]

Maritime Barge Transfer Platform

A maritime barge transfer platform could be employed if floating wharves or temporary piers cannot be constructed because of coastal conditions. Large civilian ships could unload forces and materiel at the floating platform, which would then be lightered to the beach. The floating platform would require cranes to unload cargo ships and a RO/RO unloading platform. The anchorage location would need to meet the requirements of berthing a 10,000 DWT transport ship. As with the other methods, a system would be required to protect the structure from wind and waves.[67]

Airlanding Forces and Materiel

Airlanding can augment the delivery of forces and materiel on Taiwan. Enabling aircraft to offload will also be a significant challenge. The Taiwan military will defend airports, deploy strong counterattack forces within striking distance, and destroy airport infrastructure to deny their use by the PLA. The PLA will attempt to repair damaged airports or construct landing fields for the airlanding of troops and supplies. Specialized logistics units with attached engineering assets will undertake this mission. The airfields will be vulnerable to defending firepower strikes and counterattacks. Reconnaissance will help assess the situation of the damaged airfield or intended

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Transportation Support in Landing Operations," 1-5; Wang and Wang, "Transport Delivery Force in a Cross Sea Landing Operation," 12-16.

[65] *Operational Logistics Support*, 120, 214-215; Wang et al, "Research on Logistics Support for Amphibious Landing Operations," 108-114; Wang and Wang, "Transport Delivery Force in a Cross Sea Landing Operation," 12-16.

[66] *Operational Logistics Support*, 215-216; Wang et al, "Research on Logistics Support for Amphibious Landing Operations," 108-114; Wang and Wang, "Transport Delivery Force in a Cross Sea Landing Operation," 12-16.

[67] *Operational Logistics Support*, 216-217; Wang and Wang, "Transport Delivery Force in a Cross Sea Landing Operation," 12-16.

landing site to support the development of a repair or construction plan. Unexploded ordinance and mines will require removal to allow repairs to runways and infrastructure. In addition to runway repairs, navigation aids and lights will be set up, and water supply, power sources, and communications will be installed.[68]

Materiel and POL Supply

The large number of units participating and high intensity of combat during the assault landing will require sustained and continuous supply of high volumes of ammunition, engineering explosive equipment, and POL to the beach, greatly stressing logistics support. PLA analysis of consumption rates estimates that large-scale operations will require around 30 million tons of various combat materiel and 56 million tons of oil. The ability of the logistics force to maintain a continuous flow of supplies directly affects the combat capability of the assault force and can determine the success of the landing. PLA experts stress the employment of helicopters, precision airdrop, or unmanned vehicles to provide supplies as a component of a multi-dimensional delivery system. For the near term, these methods would appear suitable primarily for emergency support (due to the system's limited capacity) rather than delivering large quantities of ammunition and POL.[69] The future fielding of large capacity unmanned systems could increase the delivery means for logistics support.

Each operational stage presents different support requirements. The joint blockade operation could be long, requiring large quantities of materiel and POL delivered at-sea by comprehensive supply ships, oil tankers, and mobilized civilian ships. The PLA estimates that a blockade in support of a joint landing campaign would be shorter than an independent blockade. The joint fire strike operation is considered relatively easier to supply from mainland bases supporting the PLARF and PLAAF. High intensity assault landing operations will have high consumption rates of ammunition and POL with high casualty and attrition rates adding to the difficulty of resupply from the sea without a port or temporary landing facilities.

Intervention by the U.S. and possibly other countries would significantly increase consumption rates by the PLAN, PLAAF, and PLARF. A blockade of the PRC, international sanctions, or embargo could impact the availability of resources and especially POL, requiring rapid mobilization of the national economy and resupply from foreign sources. However, according to PLA sources the National Defense Mobilization Law does not specifically address materiel mobilization. The PLA considers materiel mobilization capabilities as relatively solid, but meeting the needs of a large-scale conflict would stress the system. A long support preparation stage would be required to ensure the availability of resources required for the joint landing operation, possibly providing indications and warning to the adversary.[70]

The PLA assesses materiel support has improved at the strategic, campaign, and tactical levels by combining fixed and mobile support and multi-dimensional support, augmented by mobilized forces and equipment. However, support for a large-scale operation presents problems, because the PLA possesses too few support forces in general, including transport units, specialized forces and equipment, and reserve units. PLA experts also believe that the military suffers from relatively weak maritime and air support forces that do not effectively meet the requirements of large-scale conflict. Influenced for decades by the strategic concept of coastal defense, the PLA's shore-based support forces are relatively strong, compared to weak maritime mobile support forces and supply ships, and

[68] *Operational Logistics Support*, 55-56, 217-218.

[69] Ibid., 29, 200-201.

[70] Ibid., 57-58.

backward materiel handling capabilities that lack mechanization and intelligent technologies. Strategic and campaign emergency support forces are small, and the support brigades in each theater are not sufficient in numbers, capabilities, and training to provide adequate emergency mobile logistics support. According to PLA experts, the tactical level materiel support force is adequate. However, reserve support forces are not standardized and training does not meet the requirements of actual combat. They conclude it will be difficult to meet the materiel support requirements of a future large-scale operation.[71]

Key PLA sources note that materiel and POL supply will focus on combining fixed point and accompanying mobile support methods. A combination of level-by-level and skip echelon support will be used, with a reliance on the latter. Flexibility is key to ensure the timely and uninterrupted flow of supplies down echelon. Intermediate links in the logistics system should be reduced as much as possible to create a relatively flat system for rapid resupply.[72]

A large-scale landing will require vast amounts of POL. Based on PLA analysis of recent conflicts, fuel consumption can account for more than 70 percent of logistics materiel. Both military and civilian POL support would be required. Careful calculations based on numbers and types of equipment, usage, and duration of each operational stage are made to forecast consumption rates. The PLA does not believe the current structure and layout of fuel reserves is adequate. Furthermore, a chain reaction conflict with India, on the Korean peninsula or South China Sea would require additional fuel reserves for those secondary directions. The PRC relies on foreign oil, with nearly two-thirds of imported oil passing through the choke point at the Strait of Malacca. An enemy blockade would result in a national oil shortage and seriously affect military fuel supplies. Recently the PRC increased oil stockpiles to approximately 100 days of reserves, and it has constructed underground petroleum reserves and filled the available reserve storage to address this issue.[73]

A joint POL command would be created with personnel from the CMC Joint Logistics Department, Theater Commands, PLAN, PLAAF, PLAA, PLARF, and relevant government organizations. The CMC level command is responsible for overall planning, organizing, and coordinating POL support at the national level. Theater level joint POL command includes personnel from the theater, PLAAF, Fleet, PLAA, PLARF, and relevant local departments. The theater (Eastern and Southern Theaters) command is responsible for implementing joint POL support within the warzone. Operational groups or campaign formations would form a corresponding POL command organization to organize and coordinate POL support to subordinate operational units.[74]

Theater rear area oil depots form the backbone of the POL organization, supported by the basic support force composed of field oil pipeline units, emergency oil support battalions, and other mobile support forces. Local oil support forces will augment these forces. In a Taiwan invasion scenario,

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[71] Ibid., 58-59.

[72] Ibid., 201; 曹正荣 [Cao Zhengrong], ed., 信息化陆军作战 [*Informationized Army Operations*], (Beijing: National Defense University Press, 2014), 196.

[73] *Operational Logistics Support*, 133-138. Aaron Clark and Sharon Cho, "China's Oil Reserves are Close to Reaching Storage Capacity," *Bloomberg*, February 26, 2021, https://www.bloomberg.com/news/articles/2021-02-26/china-s-oil-reserves-are-close-to-reaching-storage-capacity; Meng Meng and Chen Aizhu, "China Goes Underground to Expand its Strategic Oil Reserves," *Reuters*, January 6, 2016, https://www.reuters.com/article/us-china-oil-reserves-idUSKBN0UK2NO20160106.

[74] *Operational Logistics Support*, 139-143.

modular units would be organized to form emergency oil station teams, oil pipeline units, field oil depot units, oil depot rush units, airport oil support units, and field oil stations for mobile support.[75]

Each element or phase of the joint campaign will entail unique POL support requirements. Joint fire strike POL support primarily meets the needs of conventional missile and aviation forces. The operation will be high intensity with an urgent and heavy mission to provide aviation fuel. Support for blockade operations would mainly focus on the PLAN, PLANAF and PLARF. An air and maritime blockade could consume large quantities of POL in the case of extended operations. Support for large numbers of naval forces would be the main task, with at-sea replenishment difficult under combat conditions. Support for the assault landing operation will have high requirements for POL, with difficult delivery to and over the shore during combat to seize the beach defenses and a beachhead. First echelon forces will rely on organic POL support, with the landing of the second echelon greatly increasing demand. The joint logistics force will land on the island and establish a POL forward support base under the Rear Support Group of the Logistics Forward Support Base. Pipelines from ships can provide fuel to the support base. Army Aviation can lift fuel bladders to the island to provide emergency support. The PLA assesses that on-island combat will be of short duration and limited scale, lowering logistics requirements during this stage. However, emergency support missions will be complicated by the complex terrain and destroyed or damaged infrastructure on Taiwan.[76]

Ensuring stability of POL sources is a strategic issue, with the possibility of blockade, sanctions, and an embargo complicating the situation. According to PLA sources, the PRC needs to increase oil reserves to meet wartime requirements, reduce its dependence on foreign countries for wartime crude oil, accelerate diversification of foreign oil sources, and reduce its dependence on maritime strategic choke points. This has occurred to some degree with the construction of oil pipelines and alternative routes for oil imports. But PLA experts believe that it must increase reserves of refined fuels for ships and aircraft and capacity for emergency production by refining enterprises. At the military level, increased construction and expansion of POL support bases is required. To simplify POL support, PLA experts argue that military equipment fuel types should be standardized and augmented using alternative fuels. To support POL for blockade and assault landing operations, large capacity amphibious tracked refueling vehicles are needed. The field oil pipeline network should be established to provide direct support between rear oil depots and military port oil depots. Shore to sea refueling needs strengthening with PLAN oilers and comprehensive supply ships providing accompanying support and civilian ships providing fixed point resupply along the navigation channel. Ship-to-shore support for the landing force will initially be based on amphibious resupply vehicles and fuel barrels, followed by fuel pipelines and depots established to support on-island combat.[77]

[75] Ibid., 140-141.

[76] Ibid., 144-145.

[77] Ibid., 146-149.

Exhibit 9. A PLAN auxiliary ship conducts off-shore replenishment.[78]

POL support for the landing operation will require well-trained specialized forces. However, PLA experts believe there is a gap between the existing specialized POL support force and the requirements of a large-scale landing operation. There are too few personnel for mobile POL support, so specialists would have to be pulled from oil depots, thereby weakening the depots' capabilities. Moreover, there are too few field oil pipeline units to support requirements. Reserve POL support units and local support forces, which might not have adequate training, would need to be mobilized to meet shortfalls. Additionally, POL infrastructure and supply forces are vulnerable, requiring protection. An emergency repair force, alert system, defense, camouflage, and concealment would be required to protect and restore oil support during combat. National mobilization would be required to provide sustained strategic POL support for the operation.[79]

Combat Medical Treatment and Casualty Evacuation

The PLA places great emphasis on medical treatment, rescue, and evacuation of casualties. Medical treatment and evacuation are viewed by the PLA as important to maintain troop morale. Unit concealment will be difficult, leading to high casualty rates. *Operational Logistics Support* estimates that 120,000 casualties could occur during a large-scale operation. Air and naval blockade operations and support for the sea crossing and landing operations will necessitate the rescue of personnel at sea. The vast maritime operational area with difficult sea and weather conditions will add to the complexity of maritime search and rescue. In 2017, the PLA assessed that its joint search and rescue

[78] "PLA Navy Carries Out Off-Shore Replenishment Drill in South China Sea," *China Military Online*, November 6, 2020, http://eng.mod.gov.cn/news/2020-11/06/content_4873832.htm.

[79] *Operational Logistics Support*, 138-142.

(SAR) force and organization was weak and poorly trained. Additionally, the front-line PLAN medical support force was considered weak.[80]

It is necessary to rescue personnel at sea quickly to ensure their survival. SAR is primarily implemented by ships within a formation or adjacent ships. The PLA intends to establish military and civilian integrated SAR forces, create a three-dimensional SAR system, and standardize rescue procedures, dividing the Taiwan Strait into grids with each warship in a section responsible for search and rescue operations. PLA experts argue that SAR organization and planning to determine the composition and operations of SAR forces needs to occur during peacetime to ensure rapid response during wartime. The rescue and medical capability of warships requires improvement, and an independent medical support and limited surgical capability must be created.[81]

During the landing stage casualties will be high, with severe compound injuries and burns. Adverse weather, hydrological conditions, and enemy attacks will increase the difficulty of treating and evacuating wounded at the landing site. The PLA believes that battlefield first aid at the battalion or company level needs to be implemented within ten minutes of injury, emergency treatment at the brigade level within three hours after injury, and preliminary treatment at brigade medical aid post or a field hospital within six hours. Campaign logistics will be responsible for conducting evacuation to medical institutions. The PLA considers combat medical forces at all echelons as insufficient and requiring reinforcement to improve battlefield first aid and emergency treatment. During the assault landing stage, casualty evacuation will be difficult and time-consuming, placing great importance on forward medical support units.[82]

The PLA believes that joint logistics medical capabilities are relatively strong, capable of establishing 46 field hospitals and 43 brigade medical aid posts, and process 36,000 patients a day. Military rear hospitals will be able to admit 70,000 patients after expansion. Local medical facilities will provide additional support. Field medical equipment has improved and medical supplies can support up to 600,000 troops. Combat medical support can meet the needs of 18,000 wounded, and wartime medical reserves can support up to 500,000 troops for 30 days. The PLA believes that the wounded will account for approximately 70-80 percent of total casualties.[83]

During the blockade stage, casualties will primarily occur in the PLAN and PLAAF, as well as in ground-based and civilian targets as a result of enemy strikes. Rescue of downed pilots and sailors at sea is an important mission during a blockade. PLA experts believe that PLAN medical evacuation assets are weak. The PLA assesses that the assault landing stage will account for about 60 percent of total casualties, with on-island combat accounting for 27 percent. Several medical aid posts and a specialized casualty forward rescue group will be established on each landing beach. Brigade, battalion, and company medical organizations will provide support during on-island operations.

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[80] Ibid., 171-172.

[81] Ibid., 41; 林祥国，傅益江 [Lin Xiangguo and Fu Yijiang], 联合战术兵团渡海登岛作战卫勤保障探讨 ["Discussion on Medical Support of Joint Tactical Formations in Sea Crossing and Island Landing Operations"], 东南国防医药 [*Southeast National Defense Medicine*] 8, no. 2 (2006), 147-148.

[82] *Operational Logistics Support*, 202-203; Lin and Fu, "Discussion on Medical Support of Joint Tactical Formations in Sea Crossing and Island Landing Operations," 147-148.

[83] *Operational Logistics Support*, 77-81; Lin and Fu, "Discussion on Medical Support of Joint Tactical Formations in Sea Crossing and Island Landing Operations," 147-148.

Campaign medical organizations will reinforce tactical level medical support until field hospitals are established in Taiwan.[84]

Exhibit 10. The Northern Theater Command Navy comprehensive rescue ship *Yangchenghu* participates in a joint rescue drill.[85]

Infrastructure Support

Logistics infrastructure support—which includes construction, maintenance, supply, camouflage and concealment, and emergency repair—is an important logistics mission. Airfields, military ports, field positions, and rear warehouses are basic infrastructure required for large combat operations. During the preparation stage, support is required for forces in deployed positions and assembly areas. Requisitioning of civilian buildings and houses provides quarters for troops as well as dispersal and concealment. Emergency repair to command facilities, airports, wharves, power grids, depots and battlefield positions by logistics support forces will need to be urgently carried out.[86]

Infrastructure support during the strategic deployment stage includes support for troop movement and assembly. The sea and air blockade stage will require expansion of airports and wharves, and continuous field and shore service support. The joint fire strike stage will require emergency

[84] *Operational Logistics Support*, 40, 86-90; 贺德富，苏喜生 [He Defu and Su Xisheng], 基于兵棋推演的后勤物资储备精确计算 ["Precision Calculation of Logistics Materiel Reserve Based on Wargame Deduction"], 兵器装备工程学报 [*Journal of Ordnance Equipment Engineering*] 40, no. 7 (2019), 176-179; Lin and Fu, "Discussion on Medical Support of Joint Tactical Formations in Sea Crossing and Island Landing Operations," 147-148.

[85] "Naval Search and Rescue Flotilla Conducts Joint Rescue Drill," *China Military Online*, May 1, 2022, http://eng.mod.gov.cn/news/2022-05/01/content_4910112_2.htm.

[86] *Operational Logistics Support*, 150-155.

construction, repair of damaged facilities, and facility protection and camouflage. The landing stage will require support to ensure water and power supply, and rush repair and construction of airfields and other important facilities.[87]

Although preparations began for an emergency operation against Taiwan in 2001, the PLA assessed in 2017 that the support of battlefield facilities was inefficient. Existing infrastructure was mainly constructed for defensive operations, with a lack of large operational bases and support bases to meet the requirements of large-scale offensive operations. Existing airfields, military ports, and wharves require modernization and upgrades, according to PLA sources. The PLA also assesses its ability to protect and camouflage existing infrastructure is low.[88]

War Reserves

Weakness in war materiel reserves is a critical logistics limitation. The PLA assesses that the PRC's war readiness materiel reserve is insufficient to support a large joint landing operation, and intervention by the U.S. or chain reaction conflicts in other directions would further stress war reserves. Consumption standards for combat against Taiwan were formulated in the early 2000s to guide the strengthening of war reserves. However, revision of the consumption standards had not occurred by 2017 despite force modernization and updating combat doctrine. The fielding of new weapons and equipment and the development of new operational methods requires revised consumption standards to support planning and maintenance of sufficient war reserves. It is unclear if the PLA has revised consumption rates since 2017. The PLA assesses improvements have occurred in recent years; however, the materiel reserves are designed primarily to meet non-war military operations such as disaster relief and stability maintenance operations, though they could meet the requirements of a medium scale conflict. The PLA estimated that the amount of reserves in 2017 could not meet the requirements of a large-scale war; first line depots are described as empty, second line depots as weak, and third line depots are far from the front line. Reserves of new and advanced materiel are not fully established while old materiel accounts for a large portion of the war reserves.[89]

According to PLA experts, materiel reserves in the main strategic direction and frontline tactical areas need strengthening. The military must also improve its capability to rapidly move supplies to the threatened direction, as well as increase military materiel and civilian high-tech and general material. Civil military integration needs to systematically plan and coordinate military and local reserve missions. The PLA planned to strengthen materiel reserves along the coast to form a large-scale support capability by 2015, and to accelerate construction of the scale and layout of the depot system by 2020. The status of these plans is unknown. The turnover of old reserve materiel has been hampered by bureaucratic barriers. Old materiel needs to be eliminated and new materiel reserves must be acquired to support "trump card" weapons and equipment such as precision weapons, informationized equipment and mobile systems, and specialized materiel for combat in complex terrain such as the Indian border. PLA experts believe that improved coordination between national strategic materiel reserves and economic mobilization departments is required to maintain reserves of

[87] Ibid., 164.

[88] Ibid., 155-163.

[89] Ibid., 59-60, 305; He and Su, "Precision Calculation of Logistics Materiel Reserve Based on Wargame Deduction," 176-179; 孟文华 [Meng Wenhua], 后勤战备物资储备建设浅析 ["Analysis on the Construction of Logistic Warfare Materiel Reserve"], 中国储运网 [*China Storage and Transportation Magazine*], no. 10 (2014), 168-169.

items that cannot be manufactured quickly, special materiel with high technical content, and material with high military and civilian versatility.[90]

Modernization: Precision Logistics Support Using Information and Intelligent Technologies

The CMC's military strategic guideline in the "new era" is guiding national defense modernization, including logistics construction, to fight and win wars. This includes improving logistics capabilities for transportation and delivery, battlefield materiel supply, medical support, infrastructure support, and war reserves. PLA experts assess that logistics problems are being incrementally resolved, but solutions to some of the problems remain difficult and represent bottlenecks to supporting a large landing operation.[91] The PLA believes that information and intelligent technologies enabling a precision logistics capability can resolve some logistics challenges associated with supporting a large-scale landing operation. Traditional passive logistics support methods, slow execution, bloated staffs, complex management, and bureaucratic barriers represent inherent problems restricting improvements in logistics efficiency. To overcome these impediments, PLA logistics is attempting to transition from a traditional system to achieve a more flexible and mobile capability. PLA logisticians are testing an intelligent logistics system based on artificial intelligence technology to improve planning and decision making. The PLA is also experimenting with unmanned delivery systems that could provide emergency support in the near-term and important logistics support in the mid-to-long-term if and when larger capacity UVs are deployed to the force.[92]

To address logistics weaknesses, the PLA is investing in new—at least new to the PLA—technologies to improve precision logistics support. PLA logisticians believe these technologies will provide for a modern precision logistics system that can better support operations. These technologies include intelligent driving and autonomous vehicles; automatic identification technologies; data mining technology; the Internet of Things; Big Data; cloud computing; and 5G mobile communications. The PLA believes intelligent logistics can provide timely decision making and enhanced precision logistics to include monitoring combat logistics requirements, casualties, warehouse allocation, sorting and packing, automatic loading and unloading, and rapid long-range delivery.[93]

Informationized logistics equipment can accelerate the response time that is critical for the first echelon landing force when consumption of ammunition and POL is high, casualties are heavy, and logistics forces few. Informationized systems can increase logistics efficiency by collecting and transmitting information in real-time, forecasting combat unit requirements, providing support in advance, reducing redundant links, improving response time, providing combat unit locations on the battlefield, and integrating logistics forces into a system of systems.[94]

PLA experts believe that employment of multiple delivery methods can increase the efficiency and response time of materiel supply. Ground transportation, including the integration of unmanned

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[90] *Operational Logistics Support*, 309-314; Meng, "Analysis on the Construction of Logistic Warfare Materiel Reserve," 168-169.

[91] *Operational Logistics Support*, 36, 172-173.

[92] Ibid., 218-219

[93]刘晓宝，邓海龙，蒋宁 [Liu Xiaobao, Deng Hailong, and Jiang Ning], 让军事物流建设紧扣时代脉搏 ["Let the Construction of Military Logistics Keep Pace with the Pulse of the Times"], 中国军网 [*China Military Online*], November 28, 2019, http://www.81.cn/jfjbmap/content/2019-11/28/content_248592.htm.

[94] *Operational Logistics Support*, 219.

vehicles, will remain the main method of providing high-capacity support. Precision airdrop of supplies can reach isolated units and provide emergency support. This is especially true for airborne and special operations forces in the enemy rear area. Helicopters or unmanned aerial vehicles can also support distant units and conduct emergency evacuation of wounded. Air cushion vehicles and wing-in-ground effect vehicles can land supplies on beaches that are difficult to access by other means. Deployed pipelines are a stable and efficient method to transport POL and fresh water to the forward area. Pipelines can be employed from ship to shore, and from the shore inland.[95]

Conclusion

In sum, the PLA assesses its ability to support a large-scale offensive operation is improving, but weaknesses persist in every mission area. Significant deficiencies exist in transportation and war reserves. Certain circumstances would create additional requirements and stress for logistics. For example, intervention by the U.S. could change the nature of the conflict from a war of quick decision to a protracted war and expand the area of operations. A chain reaction conflict in the South China Sea, Indian border, or the Korean peninsula would require logistics support in additional areas. A blockade, international sanctions, or an embargo would force national mobilization. War materiel reserves and especially oil would need to be stockpiled in advance, along with other strategic materiel and resources. The PLA's assessment of the characteristics of future war includes dispersed mobile forces and high consumption and destruction rates requiring highly mobile and responsive support units providing just in time precision logistics employing a highly integrated command information system.

Logistics command, coordination, and organization of forces is complex. The PLA believes that the repeated reorganization of the logistics forces has caused internal frictions, complex coordination issues, low proficiency, and difficult organizational and command issues affecting response times and the efficiency of wartime logistics support. The dual logistics system with the Joint Logistics Support Force combined with the service logistics system creates command and coordination issues when supporting a large-scale conflict. Adding to the complexity is the need to coordinate with government agencies and civilian enterprises for mobilization, requisitioning, repairs and construction, and transportation. Wartime logistics functional areas establish separate command networks from the strategic to the campaign level that could lead to coordination problems during a dynamic, large-scale operation.[96]

The lack of a full system of systems operational capability linking all the services and branches into an integrated entity creates connection problems between operational command and the logistics system. The PLA assesses that the informationization level remains relatively low in the areas of automation, information systems, and intelligent technologies. The command information system of the logistics forces does not meet requirements for major combat operations. Logistics command information system problems can disrupt logistics plans and missions, adversely affecting operations. These disruptions can hamper communications between command levels, front and rear support elements, and logistics and operational units. To address these issues, the PLA is developing a precision logistics capability based on the logistics integrated command platform to provide just in time support to operational units, but it is unclear how far these efforts have progressed.[97]PLA experts believe that each logistics mission area has weaknesses. They argue that the greatest weakness involves the delivery of forces and materiel across the Taiwan Strait to defended beaches

[95] Ibid., 219-220.

[96] Ibid., 170-171.

[97] Ibid., 38.

without the option of unloading at a port. The landing stage would see the highest destruction rates and the heaviest consumption of ammunition and POL. The PLA plans to establish floating transfer platforms and temporary wharves to enable civilian ships to support the logistics force. Enemy strikes, weather, tides, and beach conditions add to the difficulty of this operation.

The PLA regards mobilization of civilian shipping and aircraft as a problem, despite the guidance of the National Defense Mobilization Law and National Defense Transportation Law. Civilian maritime, air, and ground transportation do not adequately meet military requirements. Civilian crews are not trained for combat operations, and there is limited training with the PLA under large-scale combat conditions.

The lack of war materiel reserves presents another significant impediment to supporting a large-scale offensive operation. War reserves have been established to support disaster relief and internal stability operations. They are not stocked to support modern forces, weapons, and equipment in a large operation. Much of the materiel is old and stocked with parts for demobilized equipment. The PLA's modernization requires replacement of older reserve equipment and spare parts to support the modern equipment now deployed in the force. The current depot system is not appropriate to support a Taiwan invasion, especially if the conflict were to become protracted. Stockpiling oil and other strategic resources would be necessary in the event of escalation and protracted war.

Search and rescue, medical support, and evacuation of wounded are important missions that can affect morale. Rescuing casualties at sea will be difficult in a large area of operations with the possibility of poor weather. The PLA assesses maritime search and rescue assets as too few to support a large combat operation. Some areas of medical support are assessed as adequate, but field medical support needs improvement. The PLA is stressing field medical aid in training, but not for a large-scale amphibious operation.[98]

Infrastructure support is critical for deployment of forces and materiel to embarkation areas. The PLA believes that enemy strikes will damage or destroy key nodes, requiring repairs. The PLA currently lacks the necessary units for transportation protection and emergency repair for the rail, road, air, and waterway transportation systems spread over four Theater Commands. The PLA has inadequate transportation repair forces, with the wartime emergency repair mission depending on local transportation engineering enterprises that are ill-prepared for large-scale emergency repair operations. PLA experts believe that these problems can be solved by establishing and training local emergency repair teams and reforming the enterprise militia management system. As of 2017, the military had not formed a reliable emergency response plan.[99]

The PLA assesses that even after years of construction in the main strategic direction (i.e., the area facing Taiwan), infrastructure capabilities still faces problems supporting major combat operations. The PLA believes that airfields and ports have poor layouts and throughput capacity, with inadequate support facilities for new weapons and equipment. In 2017, PLA experts concluded that only 55 percent of the airfields had special railway lines for replenishment of oil, ammunition, and other materiel. The PLA believes many navy ports do not have the capability to support multiple ship types and do not meet the needs of high-intensity combat support. Only Fuzhou, Quanzhou, Xiamen, and some other ports in the warzone have the required heavy lifting equipment. Protection and

[98] 陈典宏 [Chen Dianhong], 真打起仗来，伤病员还能这样配合吗 ["Can the Sick and Wounded Still Cooperate in this Way When There is a Real War?"], 中国军网 [*China Military Online*], May 26, 2021 http://www.81.cn/jfjbmap/content/2021-05/26/content_290257.htm.

[99] *Operational Logistics Support*, 131.

camouflage of air and naval facilities is considered poor, with more than 80 percent of the airfield and port facilities exposed above ground. Early warning and special aircraft and missile units are not considered well-protected. Transportation lines in the area of operations are vulnerable, containing many viaducts and tunnels that are easily damaged and difficult to repair.[100]

At this time, PLA logistics capabilities likely cannot support a large-scale invasion of Taiwan. The PLA would have to initiate a significant effort to improve the multiple areas limiting logistics support. Depending on the pace and scale of efforts to improve logistics capabilities, the project would likely take at least several years once started. Such a crash effort could provide early indications and warning of an intention to invade Taiwan. Alternatively, if the PLA maintains a slow methodical approach to logistics modernization it could take at least a decade to achieve a capability to logistically support a large-scale amphibious landing on Taiwan.

[100] Ibid., 35-36

About the Author

Kevin McCauley has served as senior intelligence officer for the Soviet Union, Russia, China, and Taiwan during 31 years in the federal government, as well as an Adjunct at the RAND Corporation. He served on numerous advisory boards and working groups supporting the Intelligence Community, National Intelligence Council, and U.S. Indo-Pacific Command. McCauley has traveled extensively throughout the Asia-Pacific region for the government. His publications include “PLA System of Systems Operations: Enabling Joint Operations,” “Cultivating Joint Talent” in a forthcoming Army War College publication “The People in the People’s Liberation Army 2.0,” ”People’s Liberation Army: Army Campaign Doctrine in Transition” for the U.S. Army Training and Doctrine Command, and “Russian Influence Campaigns against the West: From the Cold War to Putin.” McCauley has provided testimony to the U.S.-Chine Economic and Security Review Commission on the Joint Logistic Support Force and Logistics Support to Expeditionary Operations. McCauley currently writes on PLA and Taiwan military affairs. He also contributes to the Foreign Military Studies Office and U.S. Army TRADOC’s OE Watch journal.