Hostile Harbors:

Taiwan's Ports and PLA Invasion Plans

Ian Easton

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PROJECT 2049 INSTITUTE

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About the Author

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Cover Image: President Tsai Ing-wen reviews a Marine Corps battalion in Kaohsiung, July 2020. *(Source: "Office of the President, Taiwan (ROC)" / "Wikimedia Commons.")*

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(Figure 1: The Taiwan Strait Area. *Source: The "Project 2049 Institute."*)

Introduction

On February 18, 2016, Chinese Communist Party (CCP) heavyweights gathered in Shanghai to witness the birth of a colossal maritime logistics conglomerate. Under the watchful gaze of Politburo members, local party leaders, and central government representatives, China COSCO Shipping Corporation emerged onto the watery scene.[1] Spawned by the unification of COSCO (China Ocean Shipping Company) Group and China Shipping Group, Beijing's newest state-owned enterprise controls over 1,000 ships, 46 container ports, 190 berths, and a legion of subsidiaries around the world – including at least four in Taiwan.[2]

CCP committees in charge of implementing the People's Republic of China (PRC, China) national military-civil fusion strategy highlighted the COSCO mega-merger.[3] Everyone who was anyone in the party-state understood what the future held for Taiwan and why the military might one day need access to those ships and ports. Since 1993, the annexation or "reunification" of Taiwan – an independent country also known as the Republic of China (ROC, Taiwan) – had been driving China's military buildup. Conquering Taiwan was something People's Liberation Army (PLA) doctrine referred to as China's "main strategic direction."[4]

War across the Taiwan Strait was hardly inevitable. It seemed possible, and at times even likely, that an interlocking campaign of political warfare undertaken by CCP operatives – men and women posted worldwide in a broad array of front organizations, associations, and companies – might be able to subvert Taiwan's democratic government and bring the island nation down without a fight.[5] Yet their success was uncertain. And if the CCP's propagandists, liaison workers, united front workers, intelligence officers, and psychological warriors all failed, the military had to be ready to use overwhelming force.[6]

The PLA war plan came in several flavors, most of them blends of mental coercion mixed with bold notes of physical destruction: operations in the electromagnetic, air, and sea domains. Chinese military planners assumed that strikes and blockades alone would be unable to force Taipei's surrender.[7] At some point, Taiwan would have to be invaded and occupied, and this would require a huge fleet of troop transports.[8] Some ships could be offloaded directly onto the island's beaches, but the vast majority would require ports in Taiwan to disgorge their lethal loads.[9]

Here, strategic planners in Beijing faced an interesting problem: How to justify the military's intervention into an ostensibly civilian logistics force? PLA uniforms would be a bad look. They would be counterproductive in an increasingly interconnected, globalized world full of statesmen and CEOs that had to remain convinced China's intentions were peaceful. How to keep the presence of the military behind-the-scenes, while simultaneously ensuring that COSCO Shipping and other strategic enterprises would be ready to execute their wartime orders if and when the time came? Enter the lawyers.

On January 1, 2017, the PRC National Defense Transportation Law went into effect. Among other things, the law mandated that all of China's basic infrastructure and related transportation platforms would henceforth be treated as military-civil fusion assets. At the CCP's discretion, they were now legally required to be designed, built, and managed to support future military operations. In the event of conflict, they would be pressed into wartime service. Now they had to prepare

accordingly in peacetime.[10] Later that same year came the PRC State Intelligence Law, which declared that all Chinese companies had to cooperate with Beijing's intelligence operations, and indeed had no legal way to refuse. The law demanded that companies cover up intelligence related activities, keeping them secret to ensure the CCP's targets of exploitation (foreign customers and business partners), never knew they were being spied on.[11]

Of course, companies in the PRC had never really been independent, legal entities capable of saying no to the Communist Party and its armed wing. The CCP has a long history of using civilian fronts to conduct military operations and collect intelligence of strategic value.[12] Companies in China have no rights beyond those allowed to them by the party-state. For its part, the CCP sits above the law and uses the law to enforce its own will.[13] Now Beijing was putting that fact in stark terms. These new laws did not state why the Communist Party felt such drastic measures were needed; that would be left to internal PLA textbooks to explain.

One such document made the benefits of military-civil fusion plain, noting that the Chinese military could now exploit over 2,000 global transport ships, 650,000 merchant marines, and one thousand subsidiary organizations for power projection.[14] Moreover, because the CCP either directly or indirectly controlled over one hundred foreign ports, those, too, could be exploited for military purposes.[15] The COSCO Shipping collective was merely the tip of the iceberg. The CCP was building a mammoth logistics complex aimed squarely at defeating Taiwan and, by extension, the United States.

This paper will explore the following questions: how is the PLA preparing to exploit existing port facilities in Taiwan to support an island invasion campaign? What are the assumptions guiding these preparations? Based on known PLA assumptions and other factors, which ports in Taiwan might be targeted for seizure in the event of an invasion and why?

(Figure 2: COSCO Shipping, a vehicle carrier ship. *Source: "Sète, Hérault" / "Wikimedia Commons."*)

(Figure 3: PLA tanks in a vehicle carrier ship during amphibious drill. *Source: "CCTV 7" / "Eastday.com."*)

The Ultra Mega

To begin, it seems important to acknowledge five fundamental points about a Taiwan invasion scenario, and to remember them as we examine the finer details.[16] Without this baseline, we might draw flawed conclusions regarding the central role that ports would likely play in Chinese amphibious operations.

First, the scale and scope of an all-out Taiwan invasion defies human comprehension. We cannot clearly see it in our minds because nothing like it has ever happened before; no point of comparison or juxtaposition exists. Our natural impulse when thinking about a future amphibious operation is to look to the past, but no event has occurred in history that is similar. The leading potential candidates, Operation Overlord (D-Day) and Operation Iceberg (the Battle of Okinawa), were each only a fraction of the size this operation would probably be and far less complex.[17]

Second, history's grandest amphibious operations were relatively simple affairs in terms of the geographic and human battlespace. The D-Day Normandy landings occurred in rural France along a relatively flat, 50-mile beachfront. The famous bluffs overlooking Normandy's beaches were only between 100 and 170 feet high, and the coastal area had been evacuated of civilians, making it a free-fire zone. The battle of Okinawa unfolded on a tiny island 66 miles long and seven miles wide, with a civilian population of around 300,000. Okinawa's highest point is Mount Yonaha, a mere 1,650 feet in elevation. Both Normandy and Okinawa were lightly garrisoned.[18]

In sharp contrast, Taiwan is an extremely rugged, heavily urbanized nation of 23,600,000 people, most of whom live on the main island, which is 245 miles long and 90 miles across at its widest point. Taiwan is made up of over 100 islands, most too tiny to see on a map. Many of Taiwan's outer islands bristle with missiles, rockets, and artillery guns. Their granite hills have been honeycombed with tunnels and bunker systems. The main island of Taiwan has 258 mountain peaks over 9,800 feet in elevation.[19] The tallest, Yushan or "Jade Mountain," is just under 13,000 feet high.[20] Unlike Normandy or Okinawa, the coastal terrain here is easily defended. Taiwan has only 14 small invasion beaches, and they are bordered by cliffs and dense urban population centers. Linkou Beach near Taipei provides an illustrative example: Towering directly over the beach is Guanyin Mountain (2,020 feet). On its right flank is the Linkou Plateau (820 feet), and to its left is Yangming Mountain (3,590 feet). Structures made of steel-reinforced concrete blanket the surrounding valleys. Taiwan gets hit by typhoons and earthquakes all the time, so each building and bridge is designed to withstand severe buffeting.

This extreme geography is thick with armed defenders. In wartime, Taiwan could mobilize a counter-invasion force of at least 450,000 troops, and probably far more. While Taiwan's standing military is only around 190,000 strong, it has a large reserve force composed primarily of recent conscripts with basic training. In 2020, Taiwan's then-defense minister estimated that 260,000 reservists could be mobilized in a worst-case scenario to augment active-duty personnel. This appears to be a conservative estimate. Over two million men in Taiwan are in the national reserve system, along with a large number of registered personnel in civilian agencies and companies – airline personnel, bulldozer operators, construction workers, truck drivers, bus drivers, fishing boat crews, firefighters, police officers, and others.[21]

Third, were it to occur, the battle for Taiwan would involve other complexities that are vital but squishy, meaning they cannot be satisfactorily quantified. It would be the first country-on-country war where both attacker and defender had modern, long-range missiles in their arsenals capable of cracking open ships and devastating land targets with precision from hundreds of miles away. No one actually knows what such a fight looks like because it has never happened before. Both sides would have advanced cyber weapons, electronic warfare suites, smart mines, and drone swarms that have never been tested in real-world combat. Both would have satellites and at least some ability to attack satellites. Both would have economic leverage to use and the ability to cripple the other's economy. Both would have large numbers of its citizens living in the other's territory, a certain but unknown number of whom are saboteurs and spies (and some of those double agents). Both would have the fearful option of using weapons of mass destruction to disperse biological, chemical, and radioactive agents against the other. And both might apply more exotic weapons, such as directed energy weapons and hypersonic missiles.

The most critical question, of course, is what the United States would do. It seems logical to assume the White House would send aid to Taiwan. Whether or not the President would order American forces to defend Taiwan is currently unknown. According to the Taiwan Relations Act, the U.S. military must plan on defending Taiwan and prepare accordingly. To date, there is no historical case in which an American President failed to send forces to support the defense of Taiwan in response to a crisis.[22] If this track record is indicative of future performance, the U.S. is almost certain to defend Taiwan in the event of a Chinese attack.

In times of crisis, American leaders will likely surge overwhelming national resources to the Taiwan Strait area and make their commitments to Taiwan's defense more explicit in hopes of convincing the PRC to de-escalate tensions. Unlike the U.S. military, the PLA has not seen combat since 1979. As a result, nobody serving today in China has any combat experience except for a handful of geriatric generals. Equally important, the Chinese military does not train in realistic, highly complex environments. These two facts call into question whether or not the PLA could actually pull off a complex invasion operation successfully.[23] If the U.S. came to Taiwan's defense, few experts would give China good odds – at least in the near term.

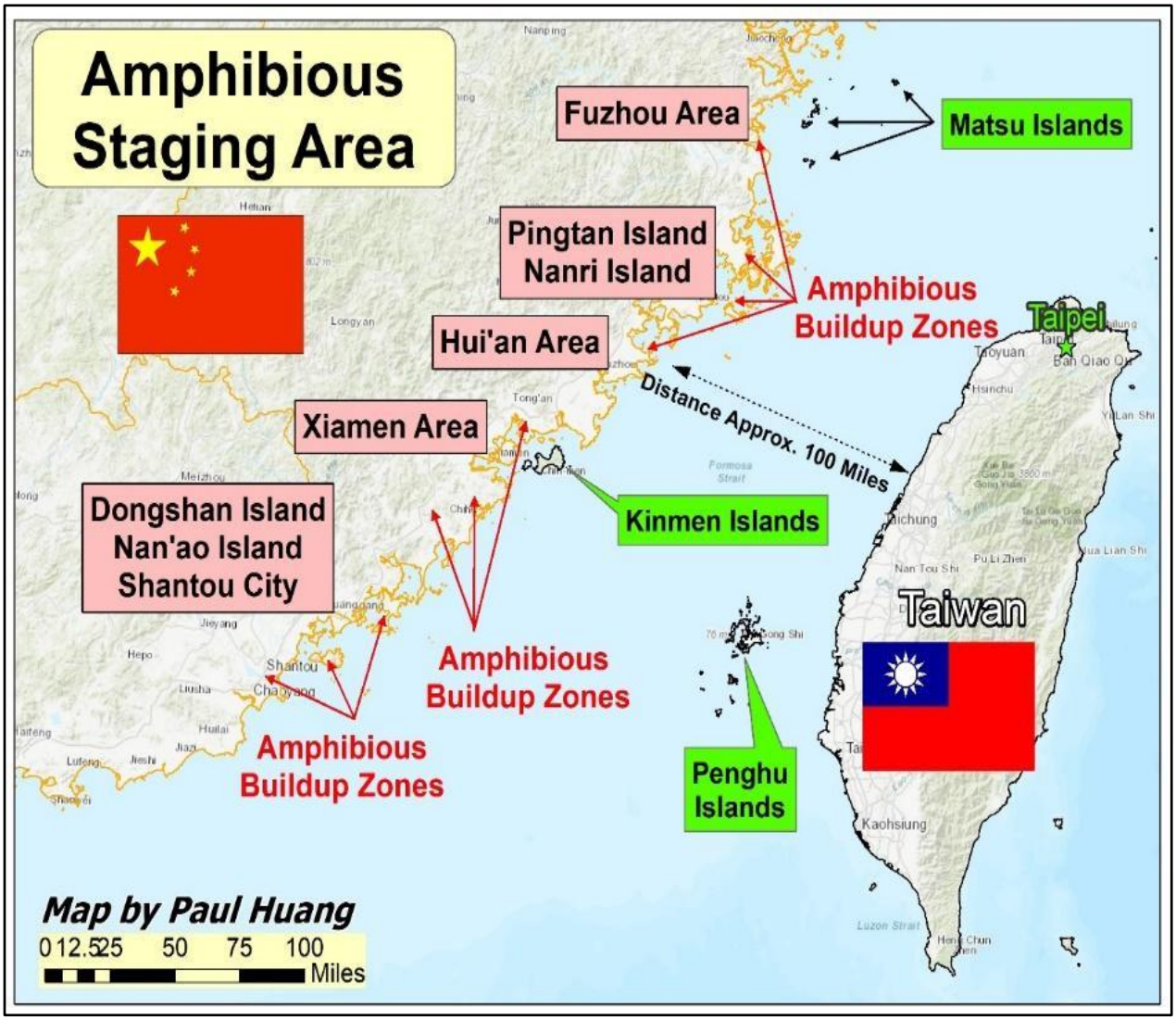
Fourth, some things we can count on, or at least estimate. The quantifiable elements of the PLA invasion operation would be mind boggling. Millions of armed forces in uniform would be mobilized in China, including soldiers, sailors, airmen, rocketeers, marines, cyber warriors, armed police, reservists, ground militia, and maritime militia. It seems likely that somewhere between one and two million combat troops would actually have to cross the Taiwan Strait, which is 80 miles at its narrowest point and 255 miles at its widest opening.[24] PLA troop numbers, of course, are highly speculative "best" guesses, which depend entirely on assumptions.

In theory, the PLA might land as few as 300,000 to 400,000 soldiers, for example, if the Taiwanese president was killed or captured prior to Z-Day and armed resistance crumbled. On the other hand, if Taiwanese government leaders survived and mobilized everything under their power in a timely fashion, the PLA might have to send over two million troops to Taiwan, including paramilitaries such as the People's Armed Police and the Militia of China. Why so many? Commanders planning offensive operations typically want a three-to-one superiority over the defender. If the terrain is unfavorable, they want a five-to-one ratio (and sometimes more). Assuming Taiwan had 450,000

defenders, the PLA general in charge would therefore want to have at least 1.35 million men, but the number would probably be closer to 2.25 million.[25]

If the PLA invasion force was a million or more men, then we might expect an armada of thousands or even tens of thousands of ships to deliver them, augmented by thousands of planes and helicopters.[26] The vast majority of these ships would not be from the PLA Navy. Vessels like tugs, oilers, barges, ferries, fishing boats, semi-submersible platforms, container carriers, and heavy roll-on/roll-off cargo ships would be mobilized. According to Chinese military sources, many ships would be deployed as decoys, conducting feints to distract attention away from the main assault.[27] For the PLA, enormous ship numbers are now attainable. The CCP's military-civil fusion strategy has been gearing up for just such an operation. China's civilian fleets are vast, and every day more hulls are being retrofitted to support a future military campaign against Taiwan.[28] Thousands of tanks, armored personnel vehicles, artillery guns, and rocket launchers would accompany the invaders. Mountains of equipment and lakes of fuel would cross with them.

Fifth, over 90 million CCP members would be supporting the war effort – along with the industrial might of a Chinese superpower with over 1.3 billion people. China's Marxist-Leninist system is uniquely capable of extracting and harnessing private resources for the state's use. According to internal PLA writings on Xi Jinping Thought, one of the Communist Party's greatest strengths is its ability to force collective action and conduct mass campaigns, especially in times of emergency.[29] The Battle of Taiwan would be the supreme emergency. It would be the ultra mega.

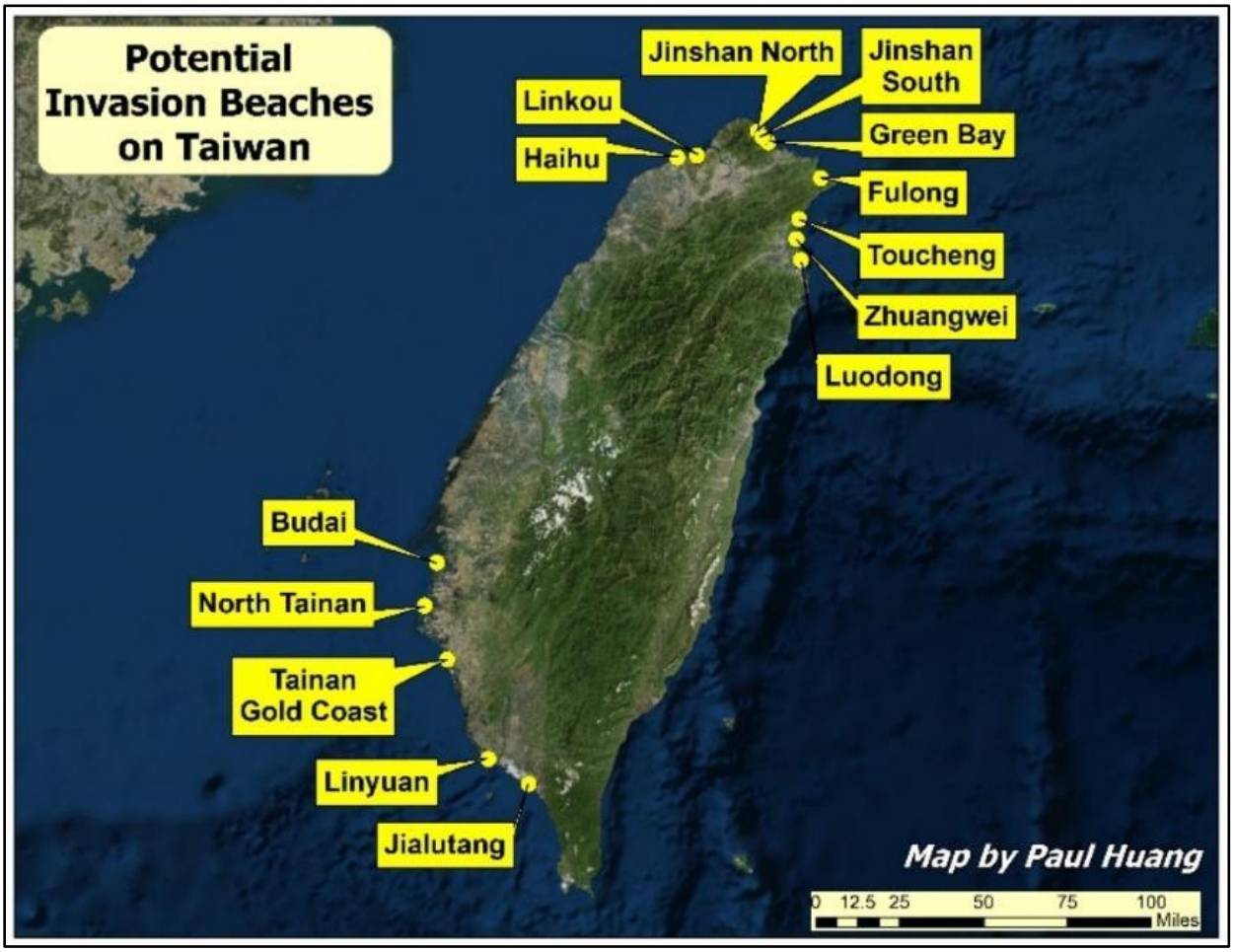


(Figure 4: PLA Amphibious Staging Area. *Source: The "Project 2049 Institute."*)

Why Ports Matter

The imagination-crushing dimensions of a PLA amphibious operation against Taiwan – the millions of moving humans and machines – all rely on robust logistic lines, without which everything else quickly crumbles and falls apart. Chinese military writings that appear indicative of doctrine argue that the success or failure of a future invasion of Taiwan would likely hinge on whether or not Chinese amphibious landing forces are able to seize, hold, and exploit the island's large port facilities.[30] Alone, Taiwan's beaches and coastal airports are too small to land enough PLA troops, tanks, and supplies to secure a solid lodgment ashore. Because these sites lack purpose-built infrastructure for unloading large transports, and because they are inherently exposed positions, PLA researchers fear Chinese landing forces could be encircled, showered with defensive fires, and then overrun by Taiwanese counterattacks.[31]

Only Taiwan's large ports could support the rapid influx of hundreds of thousands of PLA reinforcements and their heavy armor – the massive second wave force in charge of hammering into the island's inland cities and mountains. From the Chinese military's perspective, beachheads (captured beaches) and airheads (captured airports) are necessary but insufficient parts of a major amphibious landing zone.[32] According to internal PLA studies, beaches and airports might even be considered auxiliary or supporting wings, and the core, the fulcrum of an invasion of Taiwan, is that nation's own ports.[33]



(Figure 5: Potential Invasion Beaches. *Source: The "Project 2049 Institute."*)

Chinese military studies argue that the Taiwanese cannot effectively defend themselves and oppose PLA amphibious landings unless they are able to prevent the aggressor from seizing and using Taiwan's civil and military port infrastructure.[34] At least some authoritative Chinese sources portray these facilities as central to the outcome of a Taiwan invasion campaign.[35] As such, the PLA has invested remarkable resources into researching and planning how to take Taiwanese ports. This effort has included careful assessments of Taiwan's port defense plans and capabilities.

Estimating Taiwan's Port Defense Plans

PLA researchers anticipate that the Taiwanese military will make the defense of their island's ports a top priority and take extraordinary measures to secure them and, if necessary, deny them to the attacking side.[36] Sources expect that the Taiwanese military will make their ports defensive strongholds in wartime and surround them with an interlocking network of firing positions.[37] According to Chinese military writings, the center of each Taiwanese port will be defended with concentrated ground forces in well-prepared, covered defense works, which could include underground bunkers and tunnel systems.[38] Such points could be located near the ports' docks, cranes, command centers, and communication nodes.

These imagined strongholds will be watched from above by Taiwanese infantry units deployed in company and platoon-strength to firing positions in the surrounding urban buildings that overlook the ports. Spotters, snipers, and air defense units will take up positions on rooftops. Tanks, armored fighting vehicles, coastal artillery, and heavy artillery will be hidden amid "nearby infrastructure," a term likely inclusive of locations in warehouses, empty factories, man-made tunnels, improved natural caves, and under bridges. Defenders, it is assumed, will be located inside prepared defensive positions near beaches that flank port entries, as well as hilltops overlooking the ports, nearby traffic intersections, and other positions favorable to the defense.

The Chinese military assumes Taiwanese forces will operate under an air defense umbrella provided by short-range surface-to-air missiles, anti-aircraft guns, and electronic warfare vehicles. PLA studies note that the island's port defense operations could be further bolstered by any available Taiwanese Air Force fighters, Navy fast attack craft, Army helicopter gunships, coastal defense cruise missile launchers, and multiple launch rocket systems.[39] They anticipate that Taiwanese defense forces will emplace coastal mines and obstacles near the mouths of ports. Reportedly, the channels leading into and out of Taiwan's major commercial ports and naval bases already have defenses, including anti-submarine defenses and underwater surveillance arrays. These would be rapidly augmented in a conflict. PLA sources further estimate that the defenders will set up minefields and obstacles on nearby beaches, which the ROC military will cover with machine guns in block houses and entrenched firing pits. In addition to Taiwanese infantry employed in static defense positions around port areas, Chinese analysts believe the defenders will divide into specialized anti-tank teams, anti-airborne (parachute or air assault) teams, rapid reaction counterattack teams, and reserve force teams.[40] These forces are expected to occupy hardened and camouflaged positions where they can provide dense and overlapping fields of fire and maintain interior lines of communications via tunnels or covered alleyways.

PLA researchers report that Taiwan's military greatly emphasizes the application of mines and obstacles.[41] They believe Chinese amphibious forces approaching the island's ports by sea will face a combination of half-sunken ships sticking out of the surf, anchored, and floating sea mines, railroad stake emplacements, log ramps, concrete wave breakers, Belgian gates, Czech hedgehogs, and something PLA texts call "walnut crackers." Awaiting amphibious tanks in port zones will be improvised Taiwanese "success mines" (gasoline drums packed with plastic explosives and shrapnel), anti-tank mines, anti-tank ditches, anti-tank walls, and tank traps. Awaiting amphibious infantry ashore will be anti-personnel mines, Mexican sisals (fire resistant plants with circular arrangements of spikey, sword-like leaves up to six feet long), webs of barbed wire, iron crash barriers, piles of glass shards embedded in concrete, water-filled trenches, iron spike boards, anti-personnel revetments, and "contamination zones" (which the PLA reportedly fears could be comprised of poison gas or radiological agents). Together, these imagined obstacles are expected to create manmade kill-boxes inside and around ports.

Chinese military researchers believe the Taiwanese military will seal-up the mouths of vulnerable ports by sinking large container ships. If these barriers are breached by the attacking side, the defenders reportedly intend to pump oil and gasoline into their harbors to produce "seas of fire" – flaming slicks set alight to incite panic, create chaos, and produce mass casualties.[42] As a final resort, it is thought that Taiwan's military will blow up their docks, cranes, power plants, fuel

storage depots, water supply lines, causeways, and other basic port infrastructure as they retreat back into the surrounding cities, thereby denying the ports to the invader.

(Figure 6: Cargo ship *En Cheng* entering the harbor of Kaohsiung. *Source: "CEphoto, Uwe Aranas" / "Wikimedia Commons."*)

Port Attack Methods

Having described the Taiwanese military's likely port defense plans, Chinese military studies then posit six tactical approaches for overcoming the defenders and seizing their ports. Interestingly, PLA research materials weigh the pros and cons of each individual approach, giving insights into their preferences and perceived challenges. The following section offers a brief summary of their assessments.[43]

Direct Amphibious Attacks

The first approach would see undercover PLA Navy vessels transport motorized infantry units into Taiwan's ports via normal shipping channels and land them directly at the docks with amphibious landing ships or roll-on/roll-off cargo ships. The attackers would unload, fight their way across port zones, and seize surrounding urban areas. The perceived advantages of such an approach would be speed, survivability, and shock. Whereas unloading heavy equipment via beaches is a slow process, docks allow for rapid unloading; more attack units could come into action in a timely manner. Operational researchers in the Chinese military express a belief that this method could potentially save many PLA lives, while astonishing and shaking the defender's confidence and weakening morale.

The perceived disadvantages of such an approach are that it could only work when the targeted ports had already been cleared of obstacles or were left lightly defended. Even then, there could be dangers: PLA ships sailing into the ports could get ambushed and bottled up by defensive actions, including sabotage and "sea of fire" tactics. Landing units could also get hit by Taiwanese air attacks, long-range artillery bombardment, and heavy counterattacks launched by reserve units or mobility forces hiding in Taiwan's interior.

Indirect Amphibious Attacks

The PLA could land amphibious armored mechanized units on the beaches flanking Taiwan's ports. Having secured landing beaches and opened them for reinforcements to land, the attackers would conduct rapid pincer attacks to seize surrounding urban areas, encircling the ports and cutting them off from reinforcements. They would then fight their way into port zones from the inland side. The perceived advantages of such an approach are that it could work when Taiwan's ports are well defended — indeed, in such cases, PLA researchers estimate port flanks are likely to be the best weak points to exploit. Moreover, the PLA's amphibious tanks, infantry fighting vehicles, and armored transports are highly mobile — they are shock forces tailor-made for operations just like this. Ideally, port defenders would be so surprised and demoralized by being encircled, they could surrender without a fight.

There are several perceived disadvantages of such an approach. After PLA amphibious armored mechanized units get off the beach, they are likely to be overly reliant on easily severed roadways. They could get bogged down by Taiwanese minefields and obstacle networks in urban areas, especially if they are not heavily supported by combat engineers. In open areas where maneuvering is relatively easy, they could get hit by superior Taiwanese ground forces with heavy armor. A final perceived disadvantage is that such an indirect approach would be relatively slow to bear

fruit. Pincer movements take time to develop. So, the PLA might fail to quickly seize the targeted ports. This would make their infrastructure unavailable to second wave forces in a timely fashion, risking a quagmire.

Sea-Skimming Raids

The PLA could use a composite force of helicopters, hovercrafts, and ground-effect vehicles to conduct surprise attacks on port zones. By flying just above the wavetops at high speeds, these units would notionally enter ports before the defenders knew what hit them and rapidly seize their docks – along with the surrounding urban areas and military bases. A perceived advantage of such an approach is that it could be undertaken at night and in rough weather conditions, thereby shocking the defenders. Another distinctive advantage is that the attacking side could avoid sea mines and obstacles by flying directly over them. The PLA could then concentrate forces on landing zones within the ports themselves, or wherever is seen to be best by those on the scene. These notional operations would be fast and flexible.

A perceived disadvantage of such an approach is that it could only land a relatively small number of troops. For this reason, sea-skimming raids are assessed as best employed against ports that are thinly defended or ports whose defenders had already been devastated by pre-assault missile strikes. Chinese military texts state that such raids could be effective only against Taiwan's small and medium sized ports with narrow channels. Another disadvantage they anticipate is that the command and control would be difficult given the potential variety of the assets and units involved.

Air Assaults

The PLA could use large numbers of helicopters to drop troops behind Taiwan's port zones and their surrounding urban areas. The attackers would seize favorable terrain and defensive strongholds in interior areas and encircle the ports. The PLA would then attack them from their rear. The perceived advantages are many. The attackers could gain the element of surprise and get behind the defender's lines into lightly defended areas. They would avoid the "hard shell" prepared by Taiwan's military around port zones and would be able to move rapidly enough to sow chaos and avoid heavy fire. Such operations could be coordinated with seaborne amphibious assault groups to present the defenders with multidimensional and multidirectional attacks. These operations would be conducted by elite troops organized in battalion and company-sized units that are flexible and easy to coordinate.

The perceived disadvantages are that the Taiwanese military could find, counterattack, and wipe out Chinese attackers at their landing zones with overwhelming firepower. Helicopters are highly vulnerable to air defenses, making such operations perilous unless the PLA has at least localized air control, which cannot always be guaranteed near ports. A battalion-strength air assault reportedly requires two square kilometers of open space. Given the rough geographic and urban terrain around ports, suitable locations are generally only found far outside port zones. This means that the PLA could not actually seize important ports using only this method and would have to combine it with other lines of effort to be effective. On balance, however, Chinese military researchers appear to be especially impressed with the potential of air assaults to achieve favorable results as part of a broader amphibious campaign.

Horizontal Attacks

The PLA could treat ports as secondary targets. It would instead focus on traditional joint amphibious operations to capture and build up division-sized landing beaches. After the beaches and any nearby coastal airports were secure, the attackers would land second wave reinforcements in the form of armored mechanized units. These units would roll up the coastline to expand lodgments, taking port zones along the way. The perceived advantages of this approach are that the attackers could bring overwhelming troop numbers to bear against well-defended ports. Heavy land attack firepower, capable of defeating Taiwanese armor, could quickly punch through port defenses, and allow amphibious units to achieve decisive victories.

The perceived disadvantages are that the Taiwanese military could use geographic bottlenecks and defense works along coastal roads to pin down Chinese armor columns. Taiwanese tanks and artillery would be in their element – along with infantry armed with anti-tank recoilless rifles and man-portable missile launchers. Taiwan's defenders could infiltrate behind PLA lines at night or in bad weather and conduct raids on the attacker's supply lines, which might sow chaos and prolong operations to seize and open ports, rendering the second wave of the assault paralyzed.

Special Forces Infiltration

The PLA could use secret infiltration tactics to seize ports using special forces capable of covertly entering Taiwan by plane, helicopter, boat, or submarine. Undercover Chinese military teams would first conduct special reconnaissance missions, avoiding detection by the defenders while collecting intelligence on the layout of port defenses. Special units would then launch multidirectional attacks using irregular tactics to seize and hold important defense positions, bridges, road intersections, and docks until reinforcements arrive. The perceived advantages are that such operations could have a force multiplier effect, with small but elite teams surprising and overcoming larger adversary units. These operations would avoid collateral damage and protect vital infrastructure from destruction. These operations could also serve as a diplomatic coup for the attacking side by confusing and reducing the international community's response.

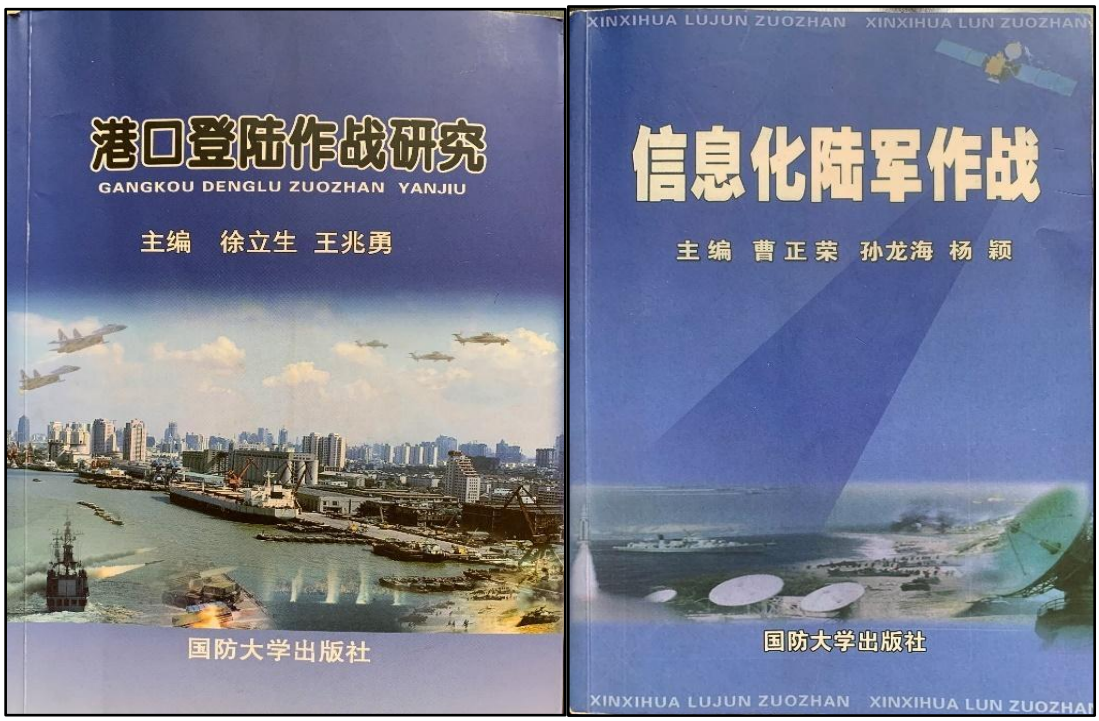
The perceived disadvantages of this approach are that it could be difficult to infiltrate into Taiwan given the defender's reconnaissance and surveillance capabilities. Special forces units are lightly armed, making them vulnerable to regular ROC Army units that have more troops and heavier firepower. If discovered, the raiders could have their clandestine communications equipment jammed. They might even be cut off from reinforcements and run out of ammunition and supplies.

Integrated Port Seizure Operations

After assessing individual tactical approaches for seizing ports, Chinese military studies such as *Research on Port Landing Operations* and *Informatized Army Operations* examine ways to combine them into an integrated operational concept.[44] They emphasize that the PLA's objective is not only to take and occupy Taiwan's large ports, but to open them and use them as soon as possible to support the overall invasion campaign. PLA researchers warn that:

> "*If ports are damaged in combat because the defending side destroys them, or because our side significantly damages them in the course of executing operations to seize them, well then, occupying those ports means nothing… We must do our utmost to ensure the least possible damage is done to port infrastructure.*"[45]

With this overriding objective in mind, our sources propose an integrated attack plan for amphibious operations against large, well-defended Taiwanese ports. That plan is summarized in the following section of the paper.[46]



(Figure 7: Internal PLA Textbooks. *Source: Library of the "Project 2049 Institute."*)

Phase One: Execute Paralyzing Strikes

PLA units will soften up the defenders prior to amphibious landings using precision strikes and joint fires that target local centers of gravity. Chinese military texts propose the following plan:

- Theater ballistic missiles, bombers, and fighter-bombers will carry out precision strikes on the defender's frontline port defenses, including early-warning sites (radars and signals

intelligence), hardened bunker facilities, air defense missile launchers, coastal defense batteries, and command posts. They will then conduct raids on the Taiwanese military's rear assembly areas and long-range artillery sites. Finally, they will intercept the defender's mobile reinforcements and reserve units as they converge on the targeted port zones.

- Shipborne guns and artillery will destroy and suppress the defender's fortifications and heavy firepower (like artillery and tanks) on nearby beachheads and inside port zones. They will then intercept the defender's frontline mobile counterassault units.
- Helicopter gunships, amphibious artillery, and amphibious tanks will destroy remaining beachhead targets, such as coastal defense batteries and tanks.

Phase Two: Conduct Commando Operations

PLA special forces units will carry out operations to pave the way forward for the main amphibious assaults. They will be inserted by helicopters, ground-effect vehicles, powered delta-winged aircraft (ultralights), and gliders. Their mission will be to seize firing positions, coastal defense batteries, and missile launch sites that pose particular threats to landing forces. They could "leapfrog" frontline beach defenses to seize key defense works in Taiwan's "shallow interior" that would have the effect of severing links between forward defenders and their rear area reinforcements. They could also infiltrate deeper into surrounding areas to conduct ambushes and raids in a manner supporting amphibious landings against ports and developing the follow-on campaign to conquer Taiwan.

Phase Three: Make Amphibious Assaults

PLA units will collect intelligence on Taiwan's port defenses "by all means necessary" and select weak points to cut through with concentrated amphibious landings made by sea and air. After beach obstacles and coastal fortifications are destroyed with direct fires, large amphibious forces will make landings from the sea, supported by troops arriving by helicopters, hovercrafts, and ultralights. Once ashore, amphibious assault units will conduct pincer movements from the beaches, surrounding port zones and isolating defenders into pockets of resistance.

Phase Four: Enter and Seize Ports

PLA amphibious assault units will conduct sea-skimming attacks over obstacles blocking the port mouths and land squarely in the middle of port zones. At the same time, PLA units will attack into the ports from multiple angles under the cover of helicopter gunships. Assault teams will pour into underground facilities and complex bunker networks, supported by combat engineers who specialize in blasting through heavy doors and walls. Amphibious tanks will smash through small buildings and, together with amphibious artillery and armored fighting vehicles, use direct fires on defending infantry platoons and companies bunkered into multistoried buildings. Attack helicopters will rake defenders in high rises with cannon and machine gun fires. Transport helicopters will ferry in growing numbers of troops to build up captured lodgments. Theater ballistic missile launchers, bombers, fighter-bombers, and shipborne guns will provide heavy fire support. Air defense missile launchers and air defense guns will create a defensive bubble around captured ports.

Phase Five: Defeat Counterattacks

PLA joint forces will fight and defeat Taiwanese counter attacks against captured port zones. When necessary, the attackers will occupy favorable terrain, stage ambushes, and turn defense obstacles against mobile units attempting to retake ports.

Phase Six: Safeguard and Exploit Ports

PLA combat engineers will clear obstacles and work to rapidly open ports, allowing a massive second wave of reinforcements with main battle tanks and other heavy equipment to continually stream into captured lodgments. The PLA will exploit port docks and cranes to offload ships, tipping the balance of forces fighting along the coast as quickly as possible. Any remaining defenders will be mopped up. As the main battle front moves inland toward the final victory, captured ports will be heavily garrisoned to protect them from potential counterattacks and saboteurs.

PLA Preparations

How is the PLA preparing the battlefield for future port landing operations? Are any port facilities and docks in Taiwan controlled by suspected PLA front companies? Do any port facilities in Taiwan already use gantry cranes made by companies with strong links to the Chinese military?

Intelligence is vital for preparing any envisioned future battlefield. Indeed, our Chinese sources indicate that intelligence collection is a priority mission. PLA texts state that the Chinese military will: "Use all available means to collect intelligence on a broad scale and thereby obtain knowledge of the port defenders' deployments and situations. Thus, we can find and exploit their weaknesses with precision."[47]

Winning over – or at least controlling and corrupting – hearts and minds is equally vital for the PLA's preparation of the future battlefield. Chinese military researchers record that: "Psychological warfare is extremely important for victory in our landing operations. Amphibious landing forces will form specialized psychological warfare units to execute compellence… crumbling the morale of those defending ports and devastating their will to resist."[48]

According to authoritative texts, the PLA will undertake psychological operations "specifically tailored to their targets by message and method," using traditional means such as propaganda broadcasts, messages in balloons, leaflets, and floating buoys – alongside messages via advanced technology tools such as social media. The Chinese military will employ "any effective measure[.] … We can also use enticements for the businessmen around the defender's port zones, getting them to spread our messages and conquer local hearts."[49]

Over the past two decades, the CCP has established representative offices in Taiwan's major ports, invested in Taiwanese port building projects, and gained direct access to at least some of Taiwan's basic port infrastructure. For example, Kaohsiung's Kao Ming Container Terminal was partially owned by a joint venture comprised of three CCP-controlled companies: China Merchants, China Shipping Terminal, and COSCO Shipping.[50] In July 2018, COSCO Shipping bought out Orient Overseas and reportedly gained outright control over the Kao Ming Container Terminal.[51] Today, this strategically located terminal in the Port of Kaohsiung uses automated "smart" cranes made in Shanghai by Shanghai Zhenhua Heavy Industries Company Limited (ZPMC), a PRC state-owned enterprise with close ties to the Chinese military.[52]

Other Taiwanese ports, including the Port of Taipei, use a significant number of cranes from ZPMC, which is a subsidiary of China Communications Construction Corp. (CCCC).[53] In August 2020, CCCC was blacklisted by the U.S. Department of Defense for its ties to the PLA.[54] In addition to cranes and other port infrastructure, ZPMC and COSCO Shipping both own large military-civil ships that have trained with the PLA and would almost certainly support amphibious landing operations against Taiwan.[55]

The automated command and control systems employed by ZPMC in ports such as Kaohsiung and Taipei (and elsewhere) use centralized networks fed by surveillance cameras deployed around the port.[56] They further leverage truck and container location tracking systems, with radio frequency identification (RFID) technology matched to each truck's chassis.[57] Since ZPMC is a CCP-owned

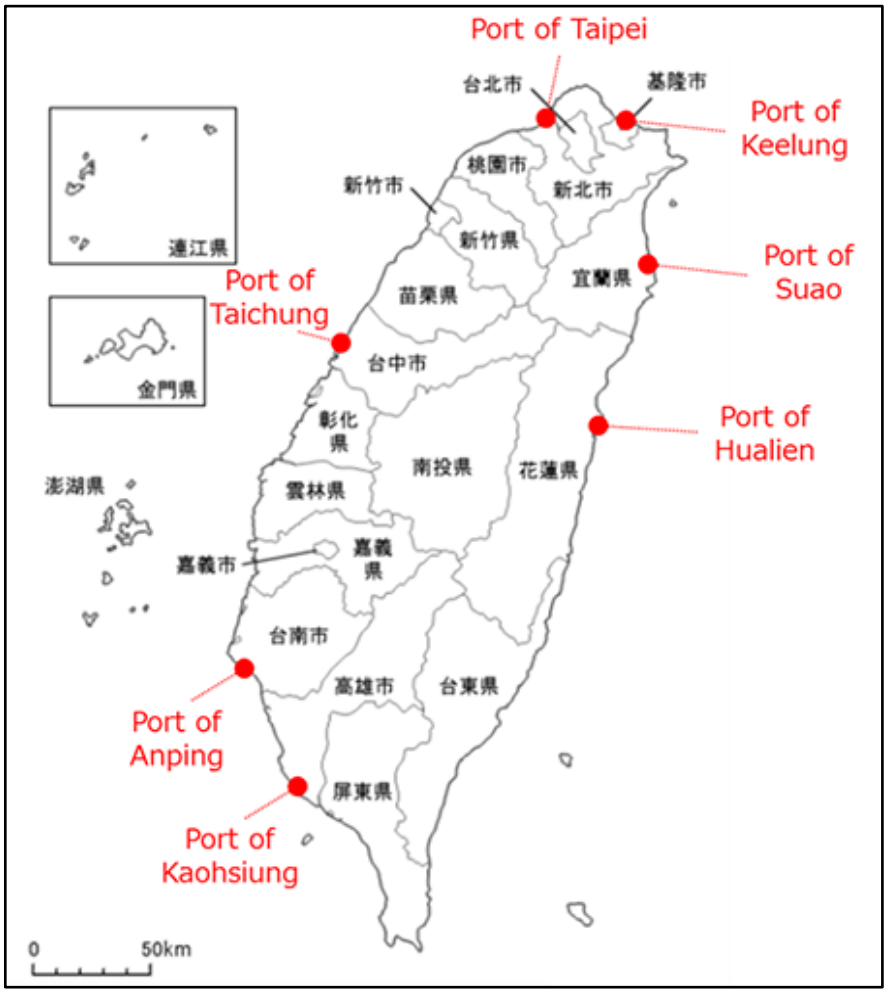
company with close ties to the PLA, it seems almost certain its automated surveillance systems could send data back to China, allowing the Chinese military to continuously collect real time intelligence on Taiwan's ports. While speculative, PLA operatives could have installed a variety of covert surveillance devices on the gantry cranes themselves.[58] In addition, the presence of CCP officers and their agents in Taiwan's major ports might allow undercover PLA operatives to develop relationships with the local business community that could be exploited for intelligence gathering and psychological warfare operations.[59]

(Figure 8: ZPMC Smart Cranes in Taiwan's Kao Ming Container Terminal. *Source: "Nippon Express."*)

(Figure 9: ZPMC Ship *Zhen Hua 28* in PLA Amphibious Drill. Source: *Andrew Tate, "Janes" / "CCTV 7."*)

Targeted Ports

Based on known PLA assumptions and other factors, which ports in Taiwan might be targeted for seizure in the event of an invasion and why? Chinese military research indicates that PLA planners are likely to take a large number of factors into consideration when determining which of Taiwan's ports to target for amphibious landings. According to sources, the Chinese military's most likely targets will be ports that could support the rapid offloading of main battle tanks and other heavy equipment. The ideal candidate for attack would be well-developed, commercial or industrial ports flanked by beaches and river deltas in relatively flat and lightly urbanized areas.[60] Based on this description, the Port of Taichung appears to be the most probable location for a major PLA landing attempt. The Port of Kaohsiung, the Port of Mailiao, the Port of Taipei, and the Port of Anping (Tainan) are potential targets that would almost certainly be considered by Chinese generals. While strategically located, the Port of Keelung appears to meet none of the geographic criteria that would make it an appealing target for seizure.



(Figure 10: Taiwan's Largest International Container Ports. *Source: "Nippon Express."*)

Internal PLA research materials view Taiwan's naval ports to be the most heavily defended and by far the most difficult to capture. However, the book *Research on Port Landing Operations* states that Taiwanese naval ports would almost certainly be targeted for "all-out" attacks and

seizure because their infrastructure is ideal for creating major landing zones and bases of operations to push inland.[61] While not mentioned by name, the Port of Zuoying appears to be the location they have in mind. The Port of Keelung and Port of Su'ao might be considered as well, but their locations would present an attacker with immense logistical challenges. The table below lists Taiwan's major ports and describes some of their important features.

Taiwanese Ports*				
Name	*Type*	*Size*	*Details and Considerations for Amphibious Operations*	*Suitability for Invasion***
Port of Kaohsiung	Commercial, Industrial, and Military	Mega	Dense urban environment, could be flanked from nearby beaches and river delta, wide range of excellent port facilities under some degree of CCP influence, overlooked by Shoushan "Monkey Mountain" (1,168 feet) and Banping Mountain (720 feet), located near major Army and Marine Corps bases, likely to be well defended.	Medium-High
Port of Zuoying	Military	Large	Urban, could be flanked from nearby beaches and river delta, overlooked by hills, overlooked by Shoushan "Monkey Mountain" (1,168 feet) and Banping Mountain (720 feet), located at large Navy and Marine Corps bases, likely to be well defended.	Medium-High
Port of Taichung	Commercial	Large	Light urban, could be flanked on both sides from river deltas and beaches, overlooked at a significant distance by the Dadu Ridgeline (1,017 feet), close to large Air force and Army bases, likely to be well defended.	High
Port of Keelung	Commercial and Military	Large	Dense urban environment, unfavorable coast for flanking attempts, close proximity to Taiwan's capital, surrounded by mountains on all sides including Wuzhi "Five Finger" Mountains (2,293 feet) and Huo/Keelung Mountains (1,929 feet), location of Navy base, likely to be well defended.	Low
Port of Taipei	Commercial	Large	Non-urban, close proximity to Taiwan's capital, has port infrastructure under some degree of CCP influence, could be flanked from large nearby beach and river delta, overlooked by Guanyin Mountain (2,021 feet), Linkou Plateau (820 feet), and	Medium-High

			Yangming Mountain (3,589 feet), located near Marine Corps and Army bases, likely to be well defended.	
Port of Su'ao	Military and Fishing	Large	Non-urban, surrounded on two sides by Qixing Mountains (750 feet), Xiaomao Mountain (2,579 feet), Dong'ao Ling Mountain (2,694 feet), and other high peaks, location of large Navy base, likely to be moderately defended.	Low
Port of Mailiao	Industrial	Medium	Non-urban, could be flanked by nearby river delta, surrounded by flat wetlands, likely to be lightly defended.	Medium
Port of Anping (Tainan)	Commercial	Small	Urban, could be flanked from small river delta and large nearby beach, surrounded by flat wetlands, nearby large Air Force base and Army aviation base, likely to be well defended.	Medium-High
Port of Hualien	Commercial	Small	Light urban, overlooked by high mountains, nearby large Air Force base and underground complex, likely to be moderately defended.	Low
Port of Makung	Military and Fishing	Small	Non-urban, main port of Penghu Island group, location of Navy base, likely to be moderately defended.	Varies***

*Sources: Geographic data comes from Google Maps, local government websites, and hiking enthusiast blogs. Information on Taiwan's order of battle can be found in *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*, pp. 283-307.
**Note that this estimate is based on the limited sources available, which are not current, and further constrained by the author's imperfect understanding of the defensive terrain and other military factors. They are best guesses only. Please take with a grain of salt.
***If the Penghu Islands were invaded, the ROC Navy base at Makung would almost certainly be the key target to seize. But whether the PLA would attack the Penghus before or during a Taiwan invasion campaign is an open question. Obviously, taking Makung would not give the PLA a foothold on Taiwan itself.

Conclusions and Recommendations

Taiwan faces an existential threat from the People's Republic of China. For the CCP, an all-out amphibious assault is only one possible course of action. The coercive options available to Beijing are limited only by the extent of imagination and could take forms that have not been anticipated by Taiwanese government leaders, who might struggle to find appropriate responses. Rather than invade, China could instead carry out subversion, blockade, or sabotage operations against Taiwan's telecommunications networks and power grid. To defeat coercion, Taiwanese government leaders must be capable of harnessing the latent power of their nation's military and civil society to find optimal responses to future Chinese actions.[62]

Internal PLA documents examined in this paper demonstrate that the Chinese party-state continues to prepare for a Taiwan invasion campaign with a remarkable degree of focus and has developed a large and growing set of military and non-military capabilities to this end. If the theories seen in Chinese military textbooks are put to the test, Taiwan's own port infrastructure could become the critical battlefield that decides which side prevails. The Taiwanese government has demonstrated a willingness to address many of its defense challenges. However, some challenges remain only partially addressed. Others have been left completely unaddressed due to their political sensitivity. One of these appears to be port security.

It is unknowable which of Taiwan's ports the PLA would ultimately select to attack in the event of war and what those attacks would look like in practice. Nonetheless, educated guesses can be made based on Chinese military research materials that have emerged on the subject, and those guesses can be tested against other sources of information, including reports on known or suspected PLA activities of relevance. Undoubtedly, a basic understanding of the local geography could prove useful to such analytic endeavors. All of this and more should help inform future efforts to make Taiwan's ports better defended and more secure.

There is much Taiwan's government can do to better protect itself from the threats examined in this paper. Taiwanese leaders could close CCP-controlled representative offices. They could remove and replace critical port infrastructure that is linked to the Chinese military. They could increase readiness and intensify current preparations for future port defense operations. To better defend against known PLA plans to invade Taiwan through its harbors, the ROC military could acquire and field significant numbers of additional missiles and mines. Taiwan could build a larger and better trained ground force, with a focus on elite units that specialize in urban warfare such as marines and military police.

Taiwan's reserve force could be overhauled to ensure the nation is capable of rapidly mobilizing hundreds of thousands of well-trained and confident personnel for homeland defense missions. Taiwan could stockpile munitions and supplies near ports. Taiwanese leaders could better educate the public about the threat, so that everyday citizens are able to identify and resist PLA political warfare operations and know how to contribute if a man-made disaster should occur. Enoch Wu and other thought leaders in Taiwan have started resilience training initiatives. These programs could be expanded and scaled-up with a focus on at-risk port cities.

As a final note, it bears emphasizing that there are many reasons why Beijing has so far elected to put off an invasion attempt and instead uses only non-lethal forms of coercion against Taiwan. Of these, Taiwan's political strength and military power are unlikely to be the main deterrent factors. U.S.-Taiwan security relations are the paramount strategic variable in the decision-making calculus of leaders on both sides of the Taiwan Strait.[63] Going forward, the United States could improve deterrence by sending marines and special operations forces to Taiwan on long-term training, advisory, and liaison missions. The U.S. could begin port defense exercises with the Taiwanese military and send high-ranking generals and admirals to participate. Today, vanishingly few senior leaders at the Pentagon could give the President of the United States expert counsel in the event of a Taiwan Strait conflict. They have never even toured Taipei, let alone examined Taiwan's coastal battlespace and interacted with their counterparts in the field.

Ultimately, the road to strategic success leads away from the application of pure military solutions to political problems. The United States and Taiwan should strive toward what Mark Stokes has dubbed an NSC (normal, stable, and constructive) relationship. The current ambiguity surrounding America's policy toward Taiwan is likely to prove structurally unstable over the long run because it isolates Taipei, emboldens Beijing, and invites miscalculation on all sides. The U.S. should continue moving away from its past policy of diplomatically isolating Taiwan, keeping it vulnerable as a concession to Beijing, and find an innovative way to treat Taiwan like the internationally important, independent country it actually is.

Appendix

The following table lists PLA units that could be involved and their envisioned roles and missions in port seizure operations.

PLA Roles and Missions in Port Landing Operations		
Unit Type	*Service/Branch*	*Roles and Missions*
Infantry	PLA Army	Motorized (and combined arms) infantry and amphibious mechanized infantry units will make amphibious landings around ports, generally in coordination with PLA Navy Marines. They will secure and expand lodgments, defeat counterattacks, support armor offensives inland, support combat engineering operations to clear obstacles and repair docks, and guard artillery and air defense assets.
Armor	PLA Army	Armored brigades and battalions with amphibious tanks will make amphibious landings in support of infantry units. They will coordinate with airborne operations, air assaults, and special forces units to seize important targets around ports. Amphibious tank units will attack upriver deltas to seize key terrain and flank port zones. Conventional armored units will land as part of the second wave to smash counterattacks, expand lodgments, and hammer inland.
Special Forces	PLA Army	Special forces will collect intelligence, carry out raids, seize and occupy strategic points, paint targets for precision strikes, and conduct psychological warfare.
Artillery	PLA Army	Long-range rocket artillery capable of reaching across the Taiwan Strait will support joint fire strikes on targets to secure control over the information, air, and sea domains. Shipborne guns will carry out direct fires on coastal defense works, obstacles, and enemy batteries to support infantry and tank landings. Amphibious artillery and anti-tank artillery units will support operations to seize, hold, and develop lodgments. Long-range artillery units will locate and destroy enemy batteries that could devastate captured ports.
Air Defense	PLA Army	Air defense units will provide a protective umbrella over all units during all stages of the invasion. They will help secure air control early in conflict. They will then protect amphibious fleets as they assemble, load, and cross the Strait. They will protect amphibious assault units as they make landings, seize ports, strengthen lodgments, and smash counterattacks. They

		will protect second wave and reserve forces as they land and push into the island.
Army Aviation	PLA Army	Army aviation (helicopter) units will engage coastal targets with direct fires prior to amphibious assaults. They will then provide fire support during the invasion and make raids on interior targets. They will make coastal air assaults, carry out electronic warfare operations, transport special forces, and conduct logistics support missions as needed.
Electronic Countermeasures	PLA Army	Electronic countermeasures units will collect electronic intelligence. They will then jam the defender's communications, radars, fire control systems, and precision guidance systems. They will conduct electronic feints and deception operations to ensure operational surprise. They will support air defense operations and amphibious operations.
PLA Air Force	PLA Air Force	Air Force units will seize and maintain air control. They will then employ bombers and fighter-bombers to strike the defender's command posts, artillery batteries, mobile reserve forces, and coastal defenses. They will provide air cover and fire support for amphibious operations and air assaults. They will coordinate with civil aviation assets to conduct airborne assaults. They will mop up targets that Army artillery units miss and help smash counterattacks.
Surface Fleet	PLA Navy	Navy units will seize and maintain sea control. They will support amphibious assaults and port seizure operations. They will resist third-party (U.S.) intervention operations. After minesweepers have cleared safe channels to shore, small numbers of naval amphibious ships and massive numbers of civilian transports will land troops and equipment on Taiwan. The surface fleet and PLA Naval Air Force will provide fire support, conduct air defense operations, and enforce maritime keep-out zones.
Marines	PLA Navy	Marine units will make amphibious landings to seize port zones independently or in coordination with army amphibious units. They will attack important targets from the coast into the island's depths. They will conduct special forces missions. They will create false targets, carry out feints, and undertake other deception operations to maintain operational surprise.
Theater Missiles	PLA Rocket Force	Ballistic and cruise missiles with theater ranges will carry out joint strikes with the Air Force at the outset of conflict to gain control over the electromagnetic and air

		domains. They will coordinate with the Navy to seize sea control and then cover amphibious operations: assembling ships, loading them, crossing the Strait, minesweeping, obstacle clearing, and landing. Next, they will provide fire support for the amphibious assaults, protecting them from counterattacking forces in the island's rear areas and depths. They will resist third party (U.S.) intervention operations.
People's Armed Police	People's Armed Police	People's Armed Police units will assemble from all across China as needed to safeguard supply lines and garrison occupied territory. They will protect against enemy raids and air attacks. They will guard critical infrastructure and, when needed, restore it. They will ensure internal stability within seized port zones. They will support logistics operations. When necessary, they will augment amphibious landing operations.
Ground and Maritime Militia	Militia of China	Militia units will assemble from all across China as needed to safeguard supply lines and garrison occupied territory. They will protect against enemy raids and air attacks. They will guard critical infrastructure and, when needed, restore it. They will ensure internal stability within seized port zones. They will support logistics operations. When necessary, they will augment amphibious landing operations.
Source: Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 72-88.		

Endnotes

[1] "China COSCO Shipping Corporation Officially Stood Up (中国远洋海运集团正式成立)," *CCP Hebei Office of the Provincial Military-Civil Fusion Development Committee*, February 23, 2016, at http://www.hbjmrh.gov.cn/xwdt/cbgy/9929.htm.

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[3] "China COSCO Shipping Corporation Officially Stood Up (中国远洋海运集团正式成立)," *CCP Hebei Provincial Office of the Military-Civil Fusion Development Committee*, February 23, 2016, at http://www.hbjmrh.gov.cn/xwdt/cbgy/9929.htm.

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operations directed at Taiwan, see Nathan Beauchamp-Mustafaga and Jessica Drun, "Exploring Chinese Military Thinking on Social Media Manipulation Against Taiwan," *China Brief*, April 12, 2021, at https://jamestown.org/program/exploring-chinese-military-thinking-on-social-media-manipulation-against-taiwan/.

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[16] The following section is adapted from the author's, "Why a Taiwan Invasion Would Look Nothing Like D-Day," *The Diplomat*, May 26, 2021, at https://thediplomat.com/2021/05/why-a-taiwan-invasion-would-look-nothing-like-d-day/.

[17] Operation Overlord employed over 6,000 ships and over 1,000 aircraft, which together landed approximately 155,000 allied troops on D-Day, including 24,000 by air. Operation Iceberg involved 1,500 ships, which landed approximately 50,000 troops on D-Day. While it remains unknown how many troops the PLA might attempt to land on Taiwan on a notional future Z-Day, the potential size of Taiwan's defending ground force (and other factors) would suggest the PLA would have to land a far larger force in the initial days of the invasion in order to have reasonable prospects of victory. For historical background, see Craig L. Symonds, *Neptune: The Allied Invasion of Europe and the D-Day Landings* (New York: Oxford University Press, 2014); Christopher D. Yung, *Gators of Neptune: Naval Amphibious Planning for the Normandy Invasion* (Annapolis, MD: Naval Institute Press, 2013); and Ronald H. Spetor, Eagle Against the Sun: The American War with Japan (New York: Vintage Books 1985), pp. 532-534.

[18] The Normandy beaches were defended by around 50,000 troops under German command. Okinawa had around 78,000 Japanese defenders, augmented by 40,000 Okinawan conscripts who had been pressed into service.

[19] Bai Guangwei (ed.), *Course Book on the Taiwan Strait's Military Geography* [台海军事地理教程] (Beijing: Academy of Military Sciences Press, 2013), p. 67; and Survey and Mapping Bureau of the PLA General Staff Department, *China's Military Geography* [中国军事地理] (Beijing: Encyclopedia of China Publishing House, 2008), p. 394.

[20] Bai Guangwei (ed.), *Course Book on the Taiwan Strait's Military Geography* [台海军事地理教程] (Beijing: Academy of Military Sciences Press, 2013), p. 68.

[21] However, it is not public information how many guns Taiwan has stockpiled for its Army, Marines, and military police reservists. Nor is it clear whether Taiwan's poorly-resourced and politically unpopular reserve system could effectively mobilize and use a significant number of them. Much too would depend on strategic early-warning, and the will of Taiwan's President and its cabinet to act with alacrity. See John Feng, "Taiwan to Begin 24/7 Simulation of Chinese Invasion," *Newsweek*, April 20, 2021, at https://www.newsweek.com/taiwan-begin-24-7-simulation-chinese-invasion-1584984; and John Feng, "Taiwan to Raise 'Temple Militia' of Holy Villagers to Fight off Chinese Invasion," *Newsweek*, April 20, 2021, at https://www.newsweek.com/taiwan-raise-temple-militia-holy-villagers-fight-off-china-invasion-1585020. For background on Taiwan's operational readiness, see Mark Stokes, Yang Kuang-shun, and Eric Lee, "Preparing for the Nightmare: Readiness and Ad hoc Coalition Operations in the Taiwan Strait," *Project 2049 Institute*, September 2020, at https://project2049.net/2020/09/01/preparing-for-the-nightmare-readiness-and-ad-hoc-coalition-operations-in-the-taiwan-strait/.

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[24] The geographical facts cited in the text come from the Survey and Mapping Bureau of the PLA General Staff Department, *China's Military Geography* [中国军事地理] (Beijing: Encyclopedia of China Publishing House, 2008), p. 337.

[25] Obviously, this is a simplistic formula. But it seems logical -- and informed guesstimates are undoubtedly better than the available alternative.

[26] In 2014, the PRC already had well over 70,000 registered transport ships, with 25,113 in Shanghai and 23,725 in Xiamen, directly across the Taiwan Strait. These vessels have grown since then in both their numbers and dual-use capabilities. See *China Port Authority Yearbook 2014* [中国口岸年鉴2014] (Beijing: China Port Authority Press, 2014), pp. 38-40. For a recent examination of military-civil fusion developments in this area, see Conor M. Kennedy, "Civil Transport in PLA Power Projection," *CMSI China Maritime Reports*, December 2019, at https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1003&context=cmsi-maritime-reports. For background on China's impressive naval shipbuilding industry, see Andrew S. Erickson, "The Chinese Naval Shipbuilding Bookshelf," *China Analysis from Original Sources*, February 11, 2021, at https://www.andrewerickson.com/2021/02/the-chinese-naval-shipbuilding-bookshelf/; and Andrew S. Erickson (ed.), *Chinese Naval Shipbuilding: An Ambitious and Uncertain Course* (Annapolis, MD: Naval Institute Press: 2016).

[27] See Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 72-88.

[28] For example, see Conor Kennedy, "Ramping the Strait: Quick and Dirty Solutions to Boost Amphibious Lift," *China Brief*, July 16, 2021, at https://jamestown.org/program/ramping-the-strait-quick-and-dirty-solutions-to-boost-amphibious-lift/.

[29] Jiang Luwu and Luo Yongguang (eds.), *Realizing the Deep Development of Military-Civil Fusion in our Overall Setup* [形成军民融合深度发展格局] (Beijing: Defense University Press, 2018), p. 203-204.

[30] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 9-12.

[31] Cao Zhengrong, Sun Longhai, and Yang Yin (eds.), *Informatized Army Operations* [信息化陆军作战] (Beijing: National Defense University Press, 2014), pp. 134-135, 169; and Cao Zhengrong, Wu Runbo, and Sun Jianjun (eds.), *Informatized Joint Operations* [信息化联合作战] (Beijing: Liberation Army Press, 2008), pp. 202-203.

[32] Cao Zhengrong, Sun Longhai, and Yang Yin (eds.), *Informatized Army Operations* [信息化陆军作战] (Beijing: National Defense University Press, 2014), pp. 140-141, 159-171.

[33] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), p. 12.

[34] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 11-12.

[35] Ibid, p. 12.

[36] Ibid, pp. 40-43.

[37] Unless otherwise noted, the following paragraphs draw from Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 40-43.

[38] Based in the context, "heavy ground forces" appears to mean armored or mechanized infantry battalions and/or brigades.

[39] Although it seems probable most would probably have already been lost or expended by the time PLA amphibious landing forces were within visual range of Taiwan.

[40] Taiwanese armored units or mechanized infantry units would likely be tasked with destroying PLA armor and clearing the PLA's airborne landing zones. Taiwanese Marines and Army special forces teams could be in charge of rapid counterattacks – although they could also be held in "strategic reserve" and tasked with nighttime raids against PLA lodgments once the daylight hours had drawn to a close.

[41] See also Cao Zhengrong, Sun Longhai, and Yang Yin (eds.), *Informatized Army Operations* [信息化陆军作战] (Beijing: National Defense University Press, 2014), p. 124.

[42] See also Cao Zhengrong, Sun Longhai, and Yang Yin (eds.), *Informatized Army Operations* [信息化陆军作战] (Beijing: National Defense University Press, 2014), p. 148.

[43] Unless otherwise noted, the following section draw from Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 44-60; and Cao Zhengrong, Sun Longhai, and Yang Yin (eds.), *Informatized Army Operations* [信息化陆军作战] (Beijing: National Defense University Press, 2014), pp. 160-163.

[44] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 61-70; and Cao Zhengrong, Sun Longhai, and Yang Yin (eds.), *Informatized Army Operations* [信息化陆军作战] (Beijing: National Defense University Press, 2014), pp. 160-163.

[45] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), p. 101.

[46] Unless otherwise noted, the following section draws from Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense

University Press, 2015), pp. 101-110; and Cao Zhengrong, Sun Longhai, and Yang Yin (eds.), *Informatized Army Operations* [信息化陆军作战] (Beijing: National Defense University Press, 2014), pp. 160-163.

[47] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), p. 104.

[48] Ibid, p. 69.

[49] Ibid, pp. 69-70.

[50] "COSCO Pacific joints hands with China Merchants International and China Shipping Terminal to invest in Kao Ming Container Terminal at Port of Kaohsiung, Taiwan," *COSCO Shipping*, December 19, 2012, at https://ports.coscoshipping.com/en/Media/PressReleases/content.php?id=20121219. See also "Interim Report 2020," *China Merchants Port Holding Company Limited*, accessed March 31, 2021, at http://www.cmport.com.hk/entouch/investor/reports.aspx; and "Local Contacts-Taiwan," *OOCL* (Costco Shipping), accessed July 7, 2021, at https://www.oocl.com/taiwan/eng/localinformation/localcontacts/Pages/default.aspx.

[51] Note that the same deal also gave COSCO control over a container terminal in the Port of Long Beach, California. However, this was only temporary, as U.S. government authorities forced COSCO to sell its business to an Australian company a year later. See Lauly Li and Zach Coleman, "Taiwan quietly lets Chinese state company take over port area," *Nikkei Asia*, September 17, 2018, at https://asia.nikkei.com/Business/Companies/Taiwan-quietly-lets-Chinese-state-company-take-over-port-area; and Chester Yung, "Cosco Shipping Units to Sell U.S. Long Beach Container Terminal for $1.78 Billion," *Wall Street Journal*, April 30, 2019, at https://www.wsj.com/articles/cosco-shipping-units-to-sell-u-s-long-beach-container-terminal-for-1-78-billion-11556595995.

[52] "ZPMC bags ASC order," *World Cargo News*, February 1, 2009, at https://www.worldcargonews.com/news-in-print/zpmc-bags-asc-order-46373. For background on ZPMC, see Kate O'Keeffe and Chun Han Wong, "U.S. Sanctions Chinese Firms and Executives Active in Contested South China Sea," *Wall Street Journal*, August 26, 2020, at https://www.wsj.com/articles/u-s-imposes-visa-export-restrictions-on-chinese-firms-and-executives-active-in-contested-south-china-sea-11598446551. See also "DOD Releases List of Additional Companies, in Accordance with Section 1237 of FY99 NDAA," *U.S. Department of Defense*, August 28, 2020, at https://www.defense.gov/Newsroom/Releases/Release/Article/2328894/dod-releases-list-of-additional-companies-in-accordance-with-section-1237-of-fy/; and "Qualifying Entities Prepared in Response to Section 1237 of the National Defense Authorization Act for Fiscal Year 1999 (PUBLIC LAW 105–261)," *U.S. Department of Defense*, August 28, 2020, at https://media.defense.gov/2020/Aug/28/2002486689/-1/-1/1/LINK_1_1237_TRANCHE-23_QUALIFYING_ENTITIES.PDF.

[53] Ibid; and "Taipei crane deal gives lift to ZPMC," *Lloyd's List*, December 11, 2007, at https://lloydslist.maritimeintelligence.informa.com/LL101894/Taipei-crane-deal-gives-lift-to-ZPMC.

[54] See "DOD Releases List of Additional Companies, in Accordance with Section 1237 of FY99 NDAA," *U.S. Department of Defense*, August 28, 2020, at https://www.defense.gov/Newsroom/Releases/Release/Article/2328894/dod-releases-list-of-additional-companies-in-accordance-with-section-1237-of-fy/; and "Qualifying Entities Prepared in Response to Section 1237 of the National Defense Authorization Act for Fiscal Year 1999 (PUBLIC LAW 105–261)," *U.S. Department of Defense*, August 28, 2020, at https://media.defense.gov/2020/Aug/28/2002486689/-1/-1/1/LINK_1_1237_TRANCHE-23_QUALIFYING_ENTITIES.PDF.

[55] Conor Kennedy, "Ramping the Strait: Quick and Dirty Solutions to Boost Amphibious Lift," *China Brief*, July 16, 2021, at https://jamestown.org/program/ramping-the-strait-quick-and-dirty-solutions-to-boost-amphibious-lift/; and
Andrew Tate, "Exercise demonstrates PLA Army Aviation ability to use commercial ships as temporary flight decks," *Janes*, August 21, 2020, at https://www.janes.com/defence-news/news-detail/exercise-demonstrates-pla-army-aviation-ability-to-use-commercial-ships-as-temporary-flight-decks.

[56] See "Automated Container Terminal in Taiwan," *Nippon Express*, November 26, 2019, at https://www.nipponexpress.com/press/report/26-Nov-19.html.

[57] Ibid.

[58] Note that when two of Kaohsiung's cranes were lost and two were damaged in a super typhoon, ZPMC repaired them with an extraordinary level of urgency (four months instead of the standard 18 months). See "Ports get cranes in a hurry," *World Cargo News*, January 1, 2017, at https://www.worldcargonews.com/news-in-print/ports-get-cranes-in-a-hurry-38624; and "Cranes down in Kaohsiung," *World Cargo News*, September 1, 2016, at https://www.worldcargonews.com/news-in-print/cranes-down-in-kaohsiung-36794.

[59] For example, COSCO, a PRC state-owned enterprise, has representative offices in Taipei, the Port of Keelung, the Port of Taichung, and the Port of Kaohsiung. See "Taiwan (台湾)," *COSCO Shipping Development Co*., accessed on April 9, 2021, at http://development.coscoshipping.com/col/col1729/index.html.

[60] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 11-14.

[61] Xu Lisheng and Wang Tiaoyong (eds.), *Research on Port Landing Operations* [港口登陆作战研究] (Beijing: National Defense University Press, 2015), pp. 13-14.

[62] Mark Stokes, Yang Kuang-shun, and Eric Lee, *Preparing for the Nightmare: Readiness and Ad hoc Coalition Operations in the Taiwan Strait* (Arlington, VA: Project 2049 Institute,

September 2020), p. 51, available online at https://project2049.net/2020/09/01/preparing-for-the-nightmare-readiness-and-ad-hoc-coalition-operations-in-the-taiwan-strait/.

[63] Mark Stokes, Yang Kuang-shun, and Eric Lee, *Preparing for the Nightmare: Readiness and Ad hoc Coalition Operations in the Taiwan Strait* (Arlington, VA: Project 2049 Institute, September 2020), p. 51, available online at https://project2049.net/2020/09/01/preparing-for-the-nightmare-readiness-and-ad-hoc-coalition-operations-in-the-taiwan-strait/.