

Taiwan's Defense Strategy and Artificial Intelligence

Dean's Scholars Thesis

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Map 1: The Taiwan Strait



Introduction

Taiwan faces an existential threat from the People's Republic of China (PRC). The PRC views Taiwan as a renegade province subject to eventual "reunification," by force if necessary.¹ The Taiwan "liberation" campaign was etched into the fabric of the People's Liberation Army (PLA) by Mao Zedong during the early days of the PRC. It defines the lives of its top-level officers, "providing their military service with purpose and value."² The PLA's main strategic direction is to "prepare for conflict with Taiwan and to deal with US intervention in such a scenario."³ In 2019, General Secretary Xi Jinping stated, "political division across the [Taiwan] strait... cannot be passed on from generation to generation."⁴ The PRC is unwavering in its irredentist desire to achieve "national reunification" by ending seven decades of self-rule in Taiwan. Although this unresolved issue has lingered for decades, its relevance will only increase as the PRC's standing rises in the world.

The future of Taiwan is not only pertinent to Greater China. Any conflict in the Taiwan Strait would ostensibly involve the US. The US government does not officially recognize PRC sovereignty over Taiwan and considers its status to be unresolved. The Taiwan Relations Act (TRA) neither guarantees nor relinquishes the ability of the US to intervene militarily in the event of a cross-Strait conflict. The TRA states, "The United States shall make available to Taiwan such defense articles and defense services in such quantity as may be necessary to enable Taiwan to maintain a sufficient self-defense capacity as determined by the President and the

¹ Chan, M. (2019, March 10). Beijing 'won't allow Taiwan reunification to be postponed indefinitely'. *South China Morning Post*.

² Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 16.

³ Kamphausen, R., & Lai, D. (2015). *The Chinese People's Liberation Army in 2025*. Carlisle, Pennsylvania: Strategic Studies Institute and U.S. Army War College Press.

⁴ Chan, M. (2019, March 10). Beijing 'won't allow Taiwan reunification to be postponed indefinitely'. *South China Morning Post*.

Congress.”⁵ Although the TRA is not as binding as a mutual defense treaty, it makes it clear that US intervention is possible, perhaps even likely, if the PRC uses force.⁶ In addition to the TRA, the US supports Taiwan for geostrategic reasons. The existence of a US-friendly regime in Taiwan is of immense strategic value considering its pivotal location adjacent to the PRC. Taiwan serves as an impediment, complicating PRC efforts to establish dominance over the Western Pacific.⁷

Given Taiwan’s precarious security situation, it should not be surprising that its military has been planning for full-scale conflict with the PLA for decades. Taiwan’s prior conventional defense strategy and its current asymmetric strategy are well documented, but certain aspects are classified.⁸ In recent years, the implementation of cutting-edge technology, such as artificial intelligence (AI), revamped Taiwan’s defense strategy. The integration of AI into weapons and military operations is a global trend that will alter the way many future wars are fought.

In order to better grasp the significance of weaponized AI more broadly, consider the emphasis the US has placed on it. In 2014, the Obama Administration implemented the Third Offset Strategy. In general, offset strategies use technology to overcome the military advantages of adversaries. Its principles are twofold: to have the military technological might to win or deter war if necessary.⁹ One of the core objectives of the Third Offset Strategy is to cultivate the most advanced AI technologies and apply them extensively to weapons and military operations.¹⁰ For context, the First Offset Strategy was implemented by President Eisenhower to achieve

⁵ H.R.2479-Taiwan Relations Act, 96th Congress. (1979) (enacted).

⁶ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan’s Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 18.

⁷ Bosco, J. (2015, May 15). Taiwan and Strategic Security. *The Diplomat*.

⁸ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan’s Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 195.

⁹ Del Monte, L. (2018). *Genius Weapons: Artificial Intelligence, Autonomous Weaponry, and the Future of Warfare*. Amherst, New York: Prometheus Books. 64.

¹⁰ Ibid 67.

technological superiority in nuclear weapons, and the Second Offset Strategy, initiated by President Ford, resulted in the creation of modern precision-guided munitions and the global positioning system (GPS).¹¹ In the face of the rapidly advancing military technological capabilities of the PRC and Russia, the US is hedging its bets on weaponized AI. The Third Offset Strategy is not actually unique. Similar initiatives have been established around the world, including Taiwan.¹²

The following sections will discuss the PRC's war plan, Taiwan's transition from a conventional defense strategy to an asymmetric strategy, as well as delve into Taiwan's use of weaponized AI and its implications. In doing so, this paper will answer the following question:

“In what ways will AI help Taiwan compel the PLA to fight a long-term conflict?”

Lengthening the duration of the conflict is a strategic goal for Taiwan because if the US decides to intervene, its corresponding military actions may not occur instantly. Defense planners in Taiwan must prepare to fend for themselves in case US intervention is delayed or fails to materialize altogether. Aside from the prospect of US intervention, it would be advantageous for Taiwan to prolong the conflict because strong actors have lost nearly 64 percent of protracted asymmetric conflicts since 1950.¹³

The scenario Taiwan faces is not entirely unique. It can be summed up in military terms as defending fortified beaches and other positions from amphibious landings. This project will contribute to the broader field by researching the role AI will play in such a defense scenario. This may be relevant to island-nations like Japan and the Philippines. Additionally, countries

¹¹ Del Monte, L. (2018). *Genius Weapons: Artificial Intelligence, Autonomous Weaponry, and the Future of Warfare*. Amherst, New York: Prometheus Books. 64-65.

¹² Tzeng, Y. (2019). *Prospect for Artificial Intelligence in Taiwan's Defense*. Jewish Policy Center.

¹³ Arreguín-Toft, I. (2008). *How the Weak Win Wars: A Theory of Asymmetric Conflict*. Cambridge, England: Cambridge University Press. 45.

involved in the South China Sea (SCS) territorial disputes may be interested in using AI to mitigate the risk of having their islands overrun by the PLA.

The PRC's War Plan

Table 1: The PRC's War Plan (i.e. The Joint Island Attack Campaign)¹⁴	
<i>Phase of Operations</i>	<i>Main Objectives</i>
1. Blockade and Bombing	Seize control of airwaves, airspace, and seascapes across the Taiwan Strait
2. Amphibious Landings	Capture beaches, ports, and airfields near Taipei and other targeted cities
3. Combat on the Island (Urban and Mountain Warfare)	Occupy Taiwan and impose will on its surviving inhabitants

In order to accurately portray Taiwan's security situation vis-à-vis the PRC, it is necessary to first analyze the PRC's war plan, which is referred to in internal PLA writings as the Joint Island Attack Campaign. Leaked PLA studies and military manuals have brought a rough picture of this campaign to light.¹⁵ The campaign encompasses a wide variety of operations in the air, land, sea, space, and cyber domains.¹⁶ The objectives of the Joint Island Attack Campaign are to: (1) expeditiously seize control of Taipei and dismantle the government; (2) to seize control of other major cities and eliminate surviving defenders; and (3) to place Taiwan and its offshore islands under military occupation.¹⁷ The PRC hopes that it can accomplish these objectives by overwhelming Taiwan and forcing surrender before the US or perhaps even a US-led coalition of countries is able to deploy ample forces to the area. Although PLA writings indicate that

¹⁴ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 142. ; Table 1 is a modified version of a table originally compiled by Easton.

¹⁵ Ibid 94.

¹⁶ Ibid 23.

¹⁷ Ibid 94.

contingency plans for fighting against US and coalition forces have been developed, the PRC would strongly prefer that the US and other countries refrain from participating.¹⁸

The PLA's Joint Island Attack Campaign can be divided into three operational phases: (1) blockade and bombing operations; (2) amphibious landing operations; and (3) combat operations on the island.¹⁹ The campaign has been devised to be executed in a sequential fashion, meaning that only when one part is finished can it proceed to the next.²⁰ This means that an interruption or defeat in any phase could potentially halt the overall operation. There are other scenarios that could occur aside from the Joint Island Attack Campaign. The PLA could pursue a relatively limited approach by enacting a long-duration blockade without escalating to the point of bombing operations and amphibious landings.²¹ Alternatively, the PLA could launch missiles near Taiwan in an attempt to coerce the populace into supporting reunification.²² However, such actions could bolster pro-independence sentiment and lead the US to deploy military forces to the area, potentially escalating the crisis into a high-stakes standoff.²³

During the 1995-1996 Taiwan Strait Crisis (a.k.a The Third Taiwan Strait Crisis), the PLA conducted a number of missile tests with some missiles landing inside of Taiwan's territorial waters.²⁴ The missile tests were meant to send a message to Taiwan's populace that voting for Lee Teng-hui in Taiwan's first truly democratic presidential election would result in

¹⁸ Ibid 94.

¹⁹ Ibid 95.

²⁰ Chase, M., Engstrom, J., Tai Ming Cheung, Gunness, K., Harold, S., Puska, S., & Berkowitz, S. (2015). Missions of the People's Liberation Army. In *China's Incomplete Military Transformation: Assessing the Weaknesses of the People's Liberation Army (PLA)*. Santa Monica, CA.: RAND. 32-34.

²¹ Ibid 32-34.

²² Heath, T. R., (2017). Chinese Political and Military Thinking Regarding Taiwan and East and South China Seas. Santa Monica, CA. RAND.

²³ Ibid.

²⁴ Tyler, P. E. (1996, March 18). China Warns U.S. to Keep Away From Taiwan Strait. *The New York Times*. ; Although the PLA missile tests certainly challenged the status quo in the Taiwan Strait, the PRC does not recognize the territorial claims of Taiwan (ROC). Therefore, the PRC did not consider its actions to be in violation of any country's territorial waters.

war.²⁵ In response to the launches, President Clinton sent two carrier battle groups to the region with the intent to diffuse tensions.²⁶ The PRC's attempt to intimidate Taiwan's populace was largely counterproductive. Rather than curb support for Lee Teng-hui, his popularity actually increased by five percent in the polls.²⁷ Although much has changed since 1996, the PRC considers anything short of a full-scale invasion to be suboptimal because it probably would not compel Taiwan to surrender. Therefore, the PRC is committed to an all-out invasion campaign.²⁸

The PLA's main objectives during phase one (i.e. blockade and bombing operations) are to obtain air and sea superiority across the Taiwan Strait. Air and sea superiority is a prerequisite to any sort of large-scale PLA amphibious landing operation. The PLA hopes it can destroy a large portion of Taiwan's air force and navy before they are able to engage by means of heavy bombing operations during the early days of the conflict.²⁹ Surviving Taiwanese fighter jets and naval vessels would engage the PLA in a battle to determine the control of the air and sea domains of the Taiwan Strait.³⁰ Upon obtaining air and sea superiority, the PLA would execute additional airstrikes and bombing raids in an attempt to destroy much of the coastal defenses of Taiwan's main island.³¹ Assuming everything up to this point went well, the PLA would commence amphibious landing operations and paratroop assaults to put boots on the ground. The bulk of PLA forces would be transported by sea while a much smaller number of special forces units would parachute into Taiwan's interior to engage in sabotage operations.³²

²⁵ Ibid.

²⁶ Ibid.

²⁷ Baron, J. (2020, August 18). The Glorious Contradictions of Lee Teng-hui. *The Diplomat*.

²⁸ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 25.

²⁹ Shlapak, D. A., Orletsky, D. T., & Wilson, B. A. (2000). *Dire Strait? Military Aspects of the China-Taiwan Confrontation and Options for U.S. Policy*. Santa Monica, CA: RAND. xiii.

³⁰ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 126.

³¹ Shlapak, D. A., Orletsky, D. T., & Wilson, B. A. (2000). *Dire Strait? Military Aspects of the China-Taiwan Confrontation and Options for U.S. Policy*. Santa Monica, CA: RAND. xiii.

³² Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 209.

Sabotage operations in general are a major concern to Taiwan. In many regards, the PRC has already infiltrated Taiwan. Within the past fifteen years, a number of individuals affiliated with Taiwan's military have been indicted on charges of spying for the PRC.³³ As recently as 2019, some Taiwanese politicians were charged for not disclosing they had accepted funds from PRC donors.³⁴ In response to malign PRC influence on Taiwanese politics, Taiwan's Legislative Yuan passed the Anti-Infiltration Act on December 31, 2019.³⁵ The law bars people from accepting money or acting on instructions from "foreign hostile forces" to lobby for political causes, make political donations, or disrupt assemblies, social order, elections, and referendums.³⁶

Taiwan's Transition from a Conventional Defense Strategy to an Asymmetric Strategy

A conventional defense strategy is one that employs conventional weapons and battlefield tactics in an open confrontation involving two or more entities. Taiwan's conventional defense strategy relied on geography and some heavily fortified islands, Kinmen and Matsu, which are situated only a few kilometers from the PRC. Kinmen was subject to artillery shellings from 1954 until the U.S. established official diplomatic ties with the PRC and severed relations with Taiwan (officially the ROC) in 1979.³⁷ However, it is important to note that for several years the PLA bombardment of Kinmen was not considered to be offensive because it occurred only on alternate days, resulting in few known casualties. Additionally, many of the PLA shells contained propaganda leaflets rather than explosives.

³³ Pan, J. (2017, May 11). Second Suspect Investigated in Spy Case. *Taipei Times*.

³⁴ Chung, L. (2019, October 30). Taiwan Charges Pro-Beijing Politicians with Accepting Funds from Chinese Mainland. *South China Morning Post*.

³⁵ Aspinwall, N. (2020, January 3). Taiwan Passes Anti-Infiltration Act Ahead of election Amid Opposition Protests. *The Diplomat*.

³⁶ Chung, L. (2019, November 25). DPP to Introduce Anti-Infiltration Bill. *Taipei Times*.

³⁷ Mathews, J. (1979, January 1). China, in Signal To Taiwan, Ends Island Shelling. *The Washington Post*.

The inability of the PLA to successfully seize control of Kinmen and Matsu made attacking Taiwan's main island unthinkable. However, over the past twenty-five years, the PLA has transformed itself into a modern military.³⁸ New PLA fifth-generation Chengdu J-20 fighters, nuclear submarines, and surface-to-air missiles have significantly reduced Taiwan's geographic advantage.³⁹ The PLA is now capable of bypassing Taiwan's offshore islands and attacking Taiwan's main island directly. Taiwan can no longer counter PLA military strengths in a conventional and symmetrical manner with fourth-generation F-16 fighters, Patriot interceptors, diesel submarines, and surface warships.⁴⁰ The PRC's known defense budget is nearly fifteen times larger than Taiwan's, making it impossible for Taiwan to compete in a conventional arms race.⁴¹ Therefore, defense planners in Taiwan have opted to pursue a strategy that emphasizes the asymmetrical advantages associated with being the defender. Rather than attempting to defeat the PLA plane for plane and soldier for soldier, Taiwan is seeking to deny the PRC its strategic objectives to land and resupply an invasion force by greatly expanding upon its asymmetric capabilities.

An asymmetric defense strategy has the potential to bolster Taiwan's defenses, giving it much better prospects. Generally, asymmetric defense strategies are centered around the idea that weak actors should avoid confrontation where the stronger adversary possesses an obvious power advantage.⁴² In the Vietnam War, asymmetric defense strategy manifested itself in the

³⁸ Heginbotham, E., Nixon, M., Morgan, F. E., Heim, J. L., Hagen, J., Li, S. T., . . . Morris, L. J. (2015). *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996 - 2017*. Santa Monica, CA: RAND. xix-xx.

³⁹ Murray, William S. (2008) "Revisiting Taiwan's Defense Strategy," *Naval War College Review*: Vol. 61 : No. 3 , Article 3. 2-4.

⁴⁰ *Ibid* 2-4.

⁴¹ Thompson, D. (2018, October 2). Hope on the Horizon: Taiwan's Radical New Defense Concept. *War on the Rocks*. University of Texas at Austin. ; Due to civil-military fusion and other factors, the PRC's actual defense budget may be much higher.

⁴² Arreguín-Toft, I. (2008). *How the Weak Win Wars: A Theory of Asymmetric Conflict*. Cambridge, England: Cambridge University Press. 35.

form of a prolonged guerrilla conflict. The North Vietnamese largely avoided fighting the US in open confrontations, choosing instead to attack US forces when they were at their weakest (e.g. surprise attacks, jungle warfare, etc.).⁴³

The power imbalance across the Taiwan Strait requires defense planners in Taiwan to harness every aspect of their relative strength.⁴⁴ Taiwan's asymmetric defense strategy maximizes defense advantages and targets an invading force when it is at its weakest.⁴⁵ The cornerstone of Taiwan's asymmetric strategy is called the Overall Defense Concept, which plans to use a wide variety of asymmetric concepts to deny the PLA the ability to land and resupply an invasion force.⁴⁶

More specifically, the Overall Defense Concept is centered around missiles, mines, and drones which Thompson (2018) calls "survivable asymmetric weapons."⁴⁷ It is anticipated that a great deal of Taiwan's conventional weapons like tanks and fighter jets will be destroyed by PLA airstrikes and missile strikes in the early days of conflict.⁴⁸ Murray (2008) goes even further by suggesting that neither Taiwan's navy nor its air force is likely to survive phase one (i.e. blockade and bombing operations) of the PLA's Joint Island Attack Campaign.⁴⁹ While Taiwan's air defense problem is perhaps one of the most difficult in the world, Taiwan is not defenseless. Taiwan possesses two mountain shelters that offer protection to a limited number of aircraft.⁵⁰

⁴³ Arreguín-Toft, I. (2008). *How the Weak Win Wars: A Theory of Asymmetric Conflict*. Cambridge, England: Cambridge University Press. 212-213.

⁴⁴ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 196.

⁴⁵ Easton, I. (2019, October 25). Is It Possible to Stop China from Seizing Taiwan? *The National Interest*.

⁴⁶ Thompson, D. (2018, October 2). Hope on the Horizon: Taiwan's Radical New Defense Concept. *War on the Rocks*. University of Texas at Austin.

⁴⁷ Ibid.

⁴⁸ Ibid.

⁴⁹ Murray, William S. (2008) "Revisiting Taiwan's Defense Strategy," *Naval War College Review*: Vol. 61 : No. 3 , Article 3. 4.

⁵⁰ Lostumbo, M. J., Frelinger, D. R., Williams, J., & Wilson, B. (2016). *Air Defense Options for Taiwan: An Assessment of Relative Costs and Operational Benefits*. Santa Monica, CA: RAND. xi.

Lostumbo (2016) finds that Taiwan would benefit greatly from investing more in asymmetric weapons like surface-to-air missiles and decreasing its reliance on fighter jets which would likely be rendered useless.⁵¹ In the past few years, Taiwan has increased its stockpile of asymmetric weapons like missiles, mines, and drones because they are more capable of surviving bombardment from the PLA. Additionally, missiles, mines, and drones are comparatively cheaper than conventional weapons.

Although Murray (2008) asserts that the PLA's modernization has greatly reduced Taiwan's geographic advantage, Easton (2019) is of the view that the 100 miles of rough ocean separating Taiwan's main island from the PRC will still play a critical role in a cross-Strait conflict. In order for the PLA to conduct phase two (i.e. amphibious landing operations) of its Joint Island Attack Campaign, it must assemble a vast number of soldiers and equipment on the PRC coast before crossing the Taiwan Strait to conduct offensive amphibious landings on Taiwan's west coast.⁵² Taiwan's east coast is typically considered to be unsuitable for amphibious landings primarily for two reasons: (1) it is very mountainous; (2) it is located farther away from the PRC.⁵³ As seen during World War I in the Gallipoli campaign, it is difficult to execute amphibious landings on beaches that are surrounded by cliffs and mountains. Even though British forces landed on the Ottoman coast in ample numbers, they were unable to maintain their positions and suffered catastrophic losses. The steep cliffs behind the invasion beaches offered the Ottomans a vantage point from which they decimated British soldiers who were out in the open and devoid of cover on the beaches.⁵⁴

⁵¹ Ibid xxi-xxiv.

⁵² Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 227.

⁵³ Ibid 148.

⁵⁴ Gatchel, T. L. (1996). *At the Water's Edge: Defending Against the Modern Amphibious Assault*. Annapolis, Maryland: Naval Institute Press. 20-21.

A major factor complicating PLA amphibious landing operations is inclement weather. The waves in the Taiwan Strait are tall enough to render amphibious landing craft inoperable for much of the year.⁵⁵ Strong winds and heavy fog also impact the ability of the PLA to conduct successful amphibious landings. There are only two time frames during a given year when weather conditions are optimal for invading Taiwan: (1) Late March to the end of April; (2) Late September to the end of October.⁵⁶ Although a PLA invasion could occur at any time, those two time frames are considered most likely because they present optimal weather conditions.

Regarding the possibility of a German amphibious invasion of Britain during World War II, General Dwight D. Eisenhower said, “Successful penetration of a defended beach is the most difficult operation in warfare.”⁵⁷ Although nearly eighty years have passed, Eisenhower’s insight is still relevant. Offensive amphibious landings are typically regarded as the most arduous military operation to successfully conduct because of the immense vulnerabilities associated with them.⁵⁸ Easton (2019) elaborates that the PLA would be vulnerable to missile strikes, bombing raids, and drone attacks during its assembling and loading phase on the PRC coast, as well as during the voyage across the Taiwan Strait.⁵⁹ Compared to Heginbotham (2015), Easton’s assessment of the PLA’s vulnerability on the PRC coast is optimistic. According to Heginbotham (2015), the PLA’s fifth-generation fighters and advanced surface-to-air missiles make its integrated air defense system (IADS) a formidable obstacle.⁶⁰ However, Heginbotham (2015)

⁵⁵ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan’s Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 166.

⁵⁶ Ibid. 170.

⁵⁷ Gatchel, T. L. (1996). *At the Water’s Edge: Defending Against the Modern Amphibious Assault*. Annapolis, Maryland: Naval Institute Press. 1-2.

⁵⁸ Ibid. 1-2.

⁵⁹ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan’s Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 227.

⁶⁰ Heginbotham, E., Nixon, M., Morgan, F. E., Heim, J. L., Hagen, J., Li, S. T., . . . Morris, L. J. (2015). *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996 - 2017*. Santa Monica, CA: RAND. xxiv-xxv.

and Easton (2019) agree that the farther PLA vessels are from the Chinese mainland, the more vulnerable they are to interdicting forces from Taiwan.

Even if a number of PLA vessels manage to cross the Taiwan Strait unscathed, they will likely find great difficulty unloading soldiers and equipment onto Taiwan's beaches, of which only 14 are suitable for amphibious landings.⁶¹ To make matters even more daunting for the PLA, Easton (2019) estimates these beaches will be fortified with naval mines, land mines, barbed wire, metal spikes, machine-gun nests, and other obstacles.⁶² By taking advantage of geographic conditions and the vulnerabilities associated with offensive amphibious operations, Taiwan's asymmetric defense strategy targets the PLA when and where it is most vulnerable.

Given that much of the scholarly world agrees that an asymmetric defense strategy better suits Taiwan's needs, Greer (2019) examines why Taiwan's transition to an asymmetric strategy has been an ongoing process. According to Greer (2019), asymmetric weapons have been criticized by a handful of politicians in Taiwan who tend to view conventional weapons, such as tanks and fighter jets as being more desirable because of the prestige associated with them.⁶³ Despite this pushback, Greer (2019) states Taiwan is generally still opting to expand its arsenal of asymmetric weapons.

Easton (2019) and Greer (2019) suggest that while conventional weapons have some importance, money could be better spent by investing in asymmetric weapons due to their greater survivability.⁶⁴ However, Murray (2008), Heginbotham (2015), Lustombo (2016), and Thompson (2018) go a step further by asserting that conventional weapons should not serve a major purpose in Taiwan's contemporary defense strategy and that Taiwan would be best suited if it greatly

⁶¹ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 151.

⁶² Ibid 206-207.

⁶³ Greer, T. (2019, September 17). Taiwan's Defense Strategy Doesn't Make Military Sense. *Foreign Affairs*.

⁶⁴ Ibid.

expanded its arsenal of asymmetric weapons instead of procuring additional conventional weapons.

Military Applications of AI

The purpose of asymmetric strategy and weapons is to amplify the power of weaker actors, increasing their likelihood of success. In military science, this is called force multiplication. Force multipliers can be strategies or cutting-edge technologies that increase the power of personnel or weapons. Asymmetric weapons like missiles, mines, and drones are force multipliers for Taiwan because they can be used to efficiently destroy comparatively expensive PLA fighter jets, tanks, and naval ships.⁶⁵ Similarly, AI is a force multiplier that can be used to complement many different aspects of Taiwan's defense strategy from weapons to reconnaissance.

AI is a broad term, covering a range of techniques from rule-following computer software programs to modern probability-based machine learning, in which computers teach themselves to carry out tasks. AI has varying degrees of sophistication and is typically categorized on a spectrum ranging from weak to strong. Weak AI can only serve a limited pre-defined number of functions while strong AI is hypothetically capable of understanding any intellectual task that a human being can. Any device with the word "smart" in the name (e.g. smartphone) is AI-assisted.⁶⁶ AI is highly capable of conducting tasks as diverse as translation, object recognition, and game playing.⁶⁷

In war, AI theoretically provides three broad services. Horowitz (2018) is the pioneer of the three-pronged approach that has been used by many scholars when categorizing the military

⁶⁵ Del Monte, L. (2018). *Genius Weapons: Artificial Intelligence, Autonomous Weaponry, and the Future of Warfare*. Amherst, New York: Prometheus Books. 64.

⁶⁶ Ibid 33.

⁶⁷ (2019, September 7). Artificial Intelligence is Changing Every Aspect of War. *The Economist*.

applications of AI. The three military applications that he outlines are: (1) to allow machines to act without human supervision; (2) to process and interpret large volumes of data; (3) to aid, or even conduct the command and control of war.⁶⁸ These three categories serve as lenses for many other scholars when conducting AI-related research. Category three is at this point in time largely theoretical. Although AI does have the capability to aid commanders while they conduct war, current technological limitations and in some cases even legal limitations prevent AI from commanding units and regiments outright.⁶⁹

Through his three-pronged approach, Horowitz (2018) comes to the conclusion that AI is an enabler, not a weapon.⁷⁰ The distinguishing factor between an enabler and a weapon can be explained with the following example: though a lethal, AI-enabled autonomous drone is a weapon, the lethal component of the drone is its missiles and bombs, not the AI. AI's status as an enabler makes it applicable to a wide range of equipment and operations.

Del Monte (2018) builds upon Horowitz (2018) by going into greater detail about drones and other robotic weapons. Horowitz (2018) focuses on what Del Monte (2018) would call fully-autonomous weapons. Del Monte (2018) emphasizes that AI's presence in robotic weapons is threefold, with fully-autonomous weapons being the apex.⁷¹ He takes the first military application of AI from Horowitz (2018)—to allow machines to act without human supervision—and adds two relatively primitive categories. Since human-controlled and human-supervised weapons still require a considerable degree of either human intervention or

⁶⁸ Horowitz, M. (2018). Artificial Intelligence, International Competition, and the Balance of Power. *Texas National Security Review*, 1(3).

⁶⁹ Konaev, M. (2019, October 29). With AI, We'll See Faster Fights, But Longer Wars. *War on the Rocks*. University of Texas at Austin.

⁷⁰ Horowitz, M. (2018). Artificial Intelligence, International Competition, and the Balance of Power. *Texas National Security Review*, 1(3).

⁷¹ Del Monte, L. (2018). *Genius Weapons: Artificial Intelligence, Autonomous Weaponry, and the Future of Warfare*. Amherst, New York: Prometheus Books. 71.

supervision, they are considered technologically primitive versus fully-autonomous weapons that do not necessarily require either.

Table 2: The Three Levels of AI		
Degree of Autonomy	Capabilities	Examples
Human-controlled (remote-controlled) weapons	Weapons that can select targets and deliver force only with a human command. ⁷²	<ul style="list-style-type: none"> ● MQ-9 Reaper drone* ● Teng Yun drone*
Human-supervised weapons	Weapons that can select targets and deliver force with the oversight of a human operator who can override the weapon's actions. ⁷³	<ul style="list-style-type: none"> ● Various cruise missiles <ul style="list-style-type: none"> ○ Tomahawk ○ HF-2E
Fully-autonomous weapons	Weapons that are capable of selecting targets and delivering force without any human control or oversight. ⁷⁴	<ul style="list-style-type: none"> ● Aegis ballistic missile defense system ● Sky Bow anti-aircraft defense system
*Some of the weapons included above like the MQ-9 Reaper and Teng Yun drones may be updated in the future to function with greater autonomy.		

AI in Taiwan's Defense Strategy

AI is integrated into Taiwan's defense strategy according to the structure of Taiwan's Anti-Invasion Plan (a.k.a. The Gu'an Plan). The following table outlines the phases of operations and main objectives of Taiwan's anti-invasion plan.

Table 3: Taiwan's Anti-Invasion Plan⁷⁵	
Phase of Operations	Main Objectives
0. Pre-Conflict	<ul style="list-style-type: none"> ● Obtain sufficient reconnaissance to determine if conflict is imminent

⁷² Ibid 70.

⁷³ Ibid 71.

⁷⁴ Ibid 71.

⁷⁵ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. Chap 6. ; Table 3 is my own creation but many of the ideas are from Easton.

1. Mobilization and Force Preservation	<ul style="list-style-type: none"> ● Prepare for PLA surprise attacks ● Mobilize reservists to fortify islands ● High-value assets bunkered down
2. Joint Interdiction	<ul style="list-style-type: none"> ● Launch joint task forces to engage and destroy Chinese amphibious fleets ● Prevent the PLA from establishing a foothold on Taiwan's main island
3. Homeland Defense	<ul style="list-style-type: none"> ● Calls for surviving Taiwanese units to fight along the coast to repel the PLA invasion ● If necessary, Taiwanese forces would fall back into the cities and mountains to fight a prolonged conflict

Phase Zero: Pre-Conflict

Taiwan's first logical step to prolong a conflict with the PLA is to prevent the PLA from having the element of surprise.⁷⁶ Taiwan attempts to achieve this through exceptional reconnaissance capabilities. Due to weather limitations, it is anticipated that conflict is most likely to ensue in April or October.⁷⁷ However, it is possible the PLA could attack at another time in an attempt to catch Taiwan by surprise. In fact, Taiwanese strategists assess that the PLA prefers a minimal warning, rapid invasion campaign that uses surprise and deception to defeat Taiwan before the US can intervene.⁷⁸ Although Easton (2019) estimates that Taiwan would know the PLA is preparing for a cross-Strait conflict 60 days before hostilities begin, improving and expanding upon Taiwan's reconnaissance capabilities is still crucial to ensure Taiwan has ample time to prepare for what is to come.⁷⁹

If Taiwan can successfully pinpoint an upcoming attack in advance, it will have time to relocate vital government decision-makers to underground command centers, preventing the

⁷⁶ Greer, T. (2018, September 25). Taiwan Can Win a War With China. *Foreign Policy*.

⁷⁷ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 170.

⁷⁸ Ibid 198-199.

⁷⁹ Ibid 90.

PLA from eliminating Taiwan's president and other officials in decapitation operations.⁸⁰ Good reconnaissance would provide Taiwan with time to detain suspected PRC intelligence operatives, scatter naval mines into the ocean, prepare beaches for amphibious landings, deploy soldiers, and assemble reservists. Taiwan would rely on its reconnaissance to distinguish feints from significant operations, and decoys from legitimate targets.⁸¹ Reconnaissance plays a critical role in Taiwan's ability to prolong the conflict and stay in the fight.

AI-assisted unmanned aerial vehicles (UAV) have the capability to bolster Taiwan's reconnaissance capabilities. In 2015, Taiwan's Ministry of National Defense unveiled the Teng Yun, an indigenously produced long-endurance UAV prototype developed by the National Chung-Shan Institute of Science and Technology (NCSIST).⁸² The Teng Yun is expected to reach production by 2021. It possesses an operating range in excess of 1,000 kilometers, a flight endurance of 24 hours, and an operational height of 25,000 ft.⁸³ Although the Teng Yun UAV has a flight endurance similar to the US Air Force's MQ-9 Reaper, its operational height and range are comparably low. Having a lower operational height will make the Teng Yun more vulnerable to PLA anti-aircraft missiles. On the other hand, the Teng Yun's ability to operate at lower altitudes may make it more difficult for PLA radars to detect. Judging from the Teng Yun's somewhat low operational range, it seems Taiwan does not plan to use it for distant missions. Rather, the Teng Yun will probably be confined to the Taiwan Strait region.

The Teng Yun UAV is equipped with autonomous navigation features as well as autonomous landing capabilities. Despite these autonomous capabilities, it is not designed to be a

⁸⁰ Ibid 86.

⁸¹ Ibid 88.

⁸² Cole, J. M. (2015, August 13). Taiwan Unveils New Long-Endurance Drone, New Weapons at Defense Trade Show. *The Diplomat*.

⁸³ Wong, K. (2019, August 19). Taiwan's NCSIST Unveils New MALE-class UAV Development. *Jane Defence Weekly*.

fully-autonomous drone. Around seven to ten pilots will be required to pilot each drone remotely.⁸⁴ In the future, as the Teng Yun UAV is updated and improved, it is expected that the required number of pilots will decrease. Eventually, it may be updated to operate fully-autonomously. Although the reconnaissance data captured by the Teng Yun will need to be analyzed by a number of intelligence analysts, this process has been greatly simplified by machines that use AI to sort and interpret data.⁸⁵ Similar to how AI can distinguish faces and identify people in reconnaissance operations, AI can spot targets that are either difficult to notice or undetectable to the human eye.

Unmanned drones are only one component of Taiwan's reconnaissance operations. Satellites also collect data that will be sorted and categorized by AI. Taiwan's National Space Organization (NSO) has designed and built seven different satellites. The NSO's latest satellite is the Formosat 7⁸⁶, which went into orbit in 2019 under the guise of collecting data on weather patterns. The Formosat 7 is much more than an ordinary weather satellite. Its powerful imaging and remote sensing functions will play a critical role in reconnaissance operations.⁸⁷ Remote sensing can detect objects that are visually hidden by detecting emitted radiation. Since the Formosat 7 has remote sensing capabilities, it will be able to collect data in areas that would have otherwise been inaccessible.

Phase One: Mobilization and Force Preservation

It is estimated that a large portion of Taiwan's high-value air force assets will be destroyed during phase one (i.e. blockade and bombing operations) of the PLA's Joint Island

⁸⁴ Scharre, P. (2019). *Army of None: Autonomous Weapons and the Future of War*. New York, NY: WW Norton & Company. 16.

⁸⁵ Morgan, F. E., Boudreaux, B., Lohn, A. J., Ashby, M., Curriden, C., Klima, K., & Grossman, D. (2020). *Military Applications of Artificial Intelligence: Ethical Concerns in an Uncertain World*. Santa Monica, CA: RAND. 20.

⁸⁶ Formosat 7 is named after Formosa, the former name of Taiwan island.

⁸⁷ Chung, L. (2019, June 25). Taiwan's Next-Generation Formosat 7 Satellite Blasts off from Kennedy Space Center. *South China Morning Post*.

Attack Campaign.⁸⁸ Although this may be an unavoidable outcome, Taiwan's missile defense shield will intercept some PLA missiles, thus protecting some aircraft from destruction. Each surviving aircraft will be one more the PLA has to deal with in the skies. Once fired, the average PLA missile would take only seven minutes to reach Taiwan's main island.⁸⁹ The PLA's new hypersonic missiles may be able to reach Taiwan's main island in under five minutes. In the event PLA missiles are launched, Taiwanese launch batteries would respond by expeditiously releasing projectiles in an attempt to intercept as many incoming PLA missiles as possible. Additionally, Taiwanese electronic warfare squadrons would assist the launch batteries by blasting beams of electrons into the airwaves to lure some PLA missiles off course.⁹⁰

At the center of Taiwan's missile defense shield is the Sky Bow III (a.k.a. Tien Kung III) surface-to-air anti-ballistic missile and anti-aircraft defense system developed indigenously by the NCSIST. Although the Sky Bow III's exact specifications remain classified, it is reported to have a detection range of approximately 400 kilometers, allowing it to detect PLA missile launches in neighboring Fujian province, as well as missiles launched from more distant provinces once they are within 400 kilometers of Taiwan.⁹¹ Sky Bow III systems located on the offshore island of Kinmen can detect and intercept launches deeper into PRC territory than missile defense systems on Taiwan's main island because Kinmen is located directly across from Xiamen harbor. Taiwan expects to spend US\$2.5 billion from 2014 to 2023 manufacturing and deploying the Sky Bow III around Taiwan's main island and Penghu.⁹² Compared to its predecessors (the Sky Bow I and II), the Sky Bow III is better at intercepting ballistic missiles

⁸⁸ Murray, William S. (2008) "Revisiting Taiwan's Defense Strategy," *Naval War College Review*: Vol. 61 : No. 3 , Article 3. 4.

⁸⁹ Liu, X. (2009). *Air Defense and Space Defense Information Systems and Their Integrated Technologies* [防空防天信息系统及其一体化技术]. **Beijing National Defense Industry Press. 25.**

⁹⁰ *Ibid* 219.

⁹¹ Mei, F.S. (2006, June 19). Medium Range Air Defense Radar. *Taiwan Defense Review*.

⁹² Pike, J. (2014, March 9). Sky Bow III / Tien Kung III. *GlobalSecurity.org*

and is considered to be highly effective against aircraft.⁹³ Even though the Sky Bow III will not provide Taiwan with an invincible shield, it will play a role in protecting many of Taiwan's assets.

Similar to the US-made Aegis ballistic missile defense system (ABMD), the Sky Bow III integrates computer technology, AI algorithms, and radar technology to pinpoint and intercept enemy missiles much quicker than a team of human analysts can.⁹⁴ Although the Sky Bow III and systems similar to it are often labeled semi-autonomous on paper, they are arguably fully-autonomous. The Sky Bow III can self-activate if it detects an incoming missile. It can also be deactivated by a human if the threat is thought to be erroneous. However, in most cases, it would be illogical to deactivate the system knowing that doing so could result in catastrophic consequences if the threat is indeed genuine.⁹⁵ For this reason, some scholars including Del Monte (2019) consider Taiwan's missile defense systems to be fully-autonomous.

According to the 2018 Annual Defense Technology Trend Analysis Report by Taiwan's Institute for National Defense and Security Research (INDSR), unmanned drones may also play a role in Taiwan's missile defense shield.⁹⁶ Aside from providing essential reconnaissance data, Taiwan's Ministry of National Defense (MND) thinks drones may be able to serve as suicidal decoys, distracting PLA missiles from Taiwan's limited quantity of F16 fighter jets. Although this remains theoretical, the MND is exploring how swarm warfare could be used to bolster Taiwan's missile defense systems. The idea here is that large numbers of small drones could assemble like a swarm of insects and lure PLA missiles from their intended targets.

⁹³ Ibid.

⁹⁴ Del Monte, L. (2018). *Genius Weapons: Artificial Intelligence, Autonomous Weaponry, and the Future of Warfare*. Amherst, New York: Prometheus Books. 74.

⁹⁵ Ibid 88.

⁹⁶ Tzeng, Y. (2019). *Prospect for Artificial Intelligence in Taiwan's Defense*. Jewish Policy Center.

If a number of high-value F16 fighters are shielded by Taiwan’s missile defense systems, although they may complicate PLA operations, F16 fighters alone will most likely not be enough to compel the PLA to fight a long-term conflict. Taiwan’s asymmetric weapons are much more likely to survive PLA bombardment. The following section will detail why Taiwan’s asymmetric weapons have the potential to pack a major punch and perhaps even hold back the PLA for an extended period of time.

Phase Two: Joint Interdiction

Table 4: Sequence of Joint Interdiction Operations (227)⁹⁷		
<i>Status of PLA forces</i>	<i>Interdicting Forces from Taiwan</i>	<i>Potential Targets of Taiwan’s Interdicting Forces</i>
Assembling and loading amphibious ships along the PRC coast	<ol style="list-style-type: none"> 1. Surface launched cruise missiles (HF-2E, Yun Feng) 2. Fighter jets (F-16, IDF) armed with joint standoff weapons, Harpoon missiles, Maverick missiles, SLAM-ER missiles, etc. 3. Ballistic missiles (TK-B, MGM-168) 4. Special operations forces 5. Drones (MQ-9 Reaper and Teng Yun) 	<ol style="list-style-type: none"> 1. Command posts, power grid 2. Airfields, docked ships, ground transportation infrastructure, radars 3. Harbor facilities, radars, command posts, bridges
Crossing the Taiwan Strait	Anti-ship missiles (Harpoons, HF-2, HF-3) launched from surviving aircraft, ships, and land bases	Amphibious assault ships, escort vessels, minesweepers
Storming beaches and moving inland	<ul style="list-style-type: none"> ● Heavy tanks (M60A3, M48H) ● Armored fighting vehicles (M48A3, M42, CM-32 Cloud Leopard) ● Infantry with anti-tank missiles (FGM-148 Javelin, etc.) ● HUMVEE with anti-tank missiles (BGM-71 TOW, etc.) ● Snipers ● Gun emplacements, machine gun nests, mortar pits, grenade launchers 	Landing craft, amphibious tanks, bulldozers, officers, combat engineers, infantry

Although many of Taiwan’s military units would remain inactive until the PLA’s initial bombing operations subsided, some might engage as soon as the conflict started. It remains

⁹⁷ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan’s Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 227. ; Table 4 is a modified version of a table originally compiled by Easton.

uncertain exactly when Taiwan intends to transition to the joint interdiction phase, but some PLA writings suspect Taiwanese counterstrikes could begin soon after conflict initiated.⁹⁸ In theory, anywhere from one to fifteen days could pass from the beginning of the conflict to when the PLA will conduct offensive amphibious landing operations.⁹⁹ However, Taiwanese defense experts anticipate a shorter time frame of four to eight days.¹⁰⁰ Although the precise timing is unforeseeable, the PLA would certainly want to expedite matters and accomplish their goals before US forces could come to Taiwan's aid.

Joint interdiction is the most crucial phase of Taiwan's anti-invasion plan. During this phase, Taiwan's military would attempt to attack the PLA on the PRC coast as they prepared to make the voyage across the Taiwan strait. Although the PRC's integrated air defense system is a formidable obstacle, it is not invincible. Some Taiwanese missiles might hit their targets in the PRC.¹⁰¹ As the bulk of the PLA's fleet crosses the Taiwan Strait and ventures closer to Taiwan's main island, it will become increasingly vulnerable to interdicting forces from Taiwan whose goal is to eliminate as many PLA vessels as possible. Each ship that is eliminated is one less Taiwan will have to contend with on the invasion beaches.

The PLA would not commence phase two (i.e. amphibious landing operations) until they have achieved air and sea superiority. Considering the immense bombing operations conducted during phase one and the overall disparity in size between the air forces and navies of the PRC and Taiwan, the PLA will probably make it to this stage. Although losses are expected to be heavy, some of Taiwan's conventional aircraft and naval vessels will in all likelihood survive the

⁹⁸ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 219.

⁹⁹ Ibid 192.

¹⁰⁰ Ibid 192.

¹⁰¹ Heginbotham, E., Nixon, M., Morgan, F. E., Heim, J. L., Hagen, J., Li, S. T., . . . Morris, L. J. (2015). *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996 - 2017*. Santa Monica, CA: RAND. xxiv-xxv.

PLA's brutal bombing operations and thus be able to engage the PLA. These forces will be greatly assisted by a variety of AI-assisted missiles and drones. Recognizing that conventional aircraft and naval vessels will not be enough, Taiwan's anti-invasion plan employs a missile-centric strategy to deny PLA fleets access to its coast.¹⁰² In fact, the PLA is much more concerned about Taiwan's anti-ship, cruise, and ballistic missiles than it is concerned about Taiwan's surviving F16 fighters and Cheng Kung-class frigates.¹⁰³

The PLA will have to contend with a variety of incoming missiles launched from various different parts of Taiwan. Some may come from the Penghu Islands and others from locations throughout Taiwan's main island.¹⁰⁴ Taiwan's indigenously-developed AI-assisted Hsiung Feng IIE (HF2E) surface-launched cruise missiles, Yun Feng supersonic land-attack cruise missiles, and Hsiung Feng III (HF-3) anti-ship missiles will play critical roles at this stage. These missiles can be launched from naval vessels or ground-mobile launchers.¹⁰⁵ Although a great deal of the missiles stored on naval vessels may be destroyed during the PLA's bombardment phase, the ground-mobile launchers have a much higher chance of surviving. They are stored in hardened shelters and can be deployed to remote launch sites on short notice.

The HF2E's confirmed operational range is in excess of 600 kilometers, providing it the operational range to strike critical targets in Fujian and Guangdong provinces. Some reports have suggested that the HF2E's operational range might be as high as 2,000 kilometers.¹⁰⁶ If the reports are accurate then the HF-2E's operational range would encompass Beijing. However,

¹⁰² Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 224.

¹⁰³ Thompson, D. (2018, October 2). Hope on the Horizon: Taiwan's Radical New Defense Concept. *War on the Rocks*. University of Texas at Austin.

¹⁰⁴ Axe, D. (2020, July 10). The Taiwanese Island Fortress That Could Halt A Chinese Invasion. *Forbes*.

¹⁰⁵ (2015, June). Missiles of Taiwan. *Nuclear Threat Initiative*. Retrieved from <https://www.nti.org/learn/countries/taiwan/delivery-systems/>

¹⁰⁶ Jennings, R. (2018, August 18). Taiwan Steps Up Production of Missiles to Create Asymmetric Advantage Over China Military Build-Up. *The Associated Press*.

even if the HF2E's reported long-range capabilities are inaccurate, Taiwan's Yun Feng supersonic land-attack cruise missile has a confirmed range between 1,200 and 2,000 kilometers, placing Beijing squarely within its operational range.¹⁰⁷ Although the HF-2E and Yun Feng's main targets are harbor facilities, radars, command posts, airfields, and docked ships, it remains possible that if Taiwan were on the verge of defeat, missile attacks on political targets in Beijing and Shanghai could be attempted.¹⁰⁸ After all, the renowned Chinese military strategist Sun Tzu once said, "Do not press a desperate enemy."¹⁰⁹

If the bulk of Taiwan's land-based missiles survive the bombardment phase then they will certainly play a crucial role in prolonging the conflict. One of Taiwan's other indigenously-produced missiles, the HF-3 is an anti-ship missile primarily designed to target and destroy PLA amphibious assault ships, escort vessels, and minesweepers as they approach Taiwan. The HF-2E, Yun Feng, and HF-3 missiles are all equipped with infrared homing and fully-autonomous target recognition for terminal guidance. Stated differently, the HF-2E, Yun Feng, and HF-3 missiles are heat-seeking and they autonomously guide themselves towards their targets.

Taiwan's indigenous missiles may be accompanied by a range of US-manufactured missiles. In October of 2020, the US Department of State approved over \$3 billion worth of arms sales to Taiwan.¹¹⁰ In total, the Trump Administration has approved nearly \$16 billion worth of arms sales to Taiwan. Taiwan's purchases include a variety of conventional and asymmetric weapons. Although Taiwan has an extended history of purchasing weapons from the US, the

¹⁰⁷ Axe, D. (2020, July 17). If China Invades, Taiwan Could Target Shanghai and Beijing With Cruise Missiles. *Forbes*.

¹⁰⁸ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 223.

¹⁰⁹ Arreguín-Toft, I. (2008). *How the Weak Win Wars: A Theory of Asymmetric Conflict*. Cambridge, England: Cambridge University Press. iix.

¹¹⁰ Girard, B. (2020, October 30). With New Offensive Weapons Package, Trump Administration Goes All-in for Taiwan. *The Diplomat*.

sales approved during October of 2020 are particularly noteworthy. If approved by Congress, Taiwan will obtain 400 Harpoon anti-ship missiles, 64 MGM-168 army tactical missile systems, 135 SLAM-ER missiles, 100 launcher transporters, 25 radar trucks, and much more.¹¹¹

Taiwan's deputy defense minister, Chang Che-ping, said the October of 2020 arms sales will help Taiwan achieve its goal of "being able to destroy half of any enemy force by 2025."¹¹² Even if Taiwan's deputy defense minister is being overly optimistic, the recent weapons sales are still significant. The missiles Taiwan is procuring are to a great extent land-based. Taiwan has previously purchased a number of missiles from the US that can only be launched from ships and aircraft. Considering that a great deal of Taiwan's air force and navy will be eliminated during the early days of the conflict, those missiles might never get utilized. However, the land-based missiles Taiwan is currently acquiring are much more likely to survive PLA bombardment and will supplement Taiwan's indigenous land-based HF-2E, Yun Feng, and HF-3 missiles.¹¹³ Similar to Taiwan's indigenous missiles, the US-made missiles Taiwan is acquiring are also AI-assisted.

The Taiwan Relations Act says that "it is the policy of the United States... to provide Taiwan with arms of a defensive character."¹¹⁴ However, the 135 SLAM-ER missiles that the Department of State approved to be sold to Taiwan were actually used offensively in Iraq.¹¹⁵ With a range of approximately 150 miles, the SLAM-ER gives Taiwan's air force "improved stand-off capabilities, and could potentially strike targets across the Taiwan Strait... without the

¹¹¹ Defense Security Cooperation Agency, Department of Defense. (2020, October 26). *Taipei Economic and Cultural Representative Office in the United States (TECRO) - RGM-84L-4 Harpoon Surface Launched Block II Missiles*[Press release]. ; This weapons sale will in all likelihood be approved by Congress.

¹¹² Chung, L., & Huang, K. (2020, October 28). Latest US Arms Sale to Taiwan 'Will Help Destroy Half of Any Chinese Invasion Force'. *South China Morning Post*.

¹¹³ Ibid.

¹¹⁴ H.R.2479-Taiwan Relations Act, 96th Congress. (1979) (enacted).

¹¹⁵ Girard, B. (2020, October 30). With New Offensive Weapons Package, Trump Administration Goes All-in for Taiwan. *The Diplomat*.

jets having to leave Taiwanese airspace.¹¹⁶ In other words, the various different types of US-made missiles Taiwan is purchasing will extend Taiwan's defensive perimeter.¹¹⁷ Perhaps most significantly, on paper these missiles give Taiwan the ability to make precise attacks on PLA air and sea assets within the confines of the Taiwan Strait. The more PLA assets Taiwanese missiles destroy the harder it will be and the longer it will take for the PLA to establish a foothold on Taiwan.

Taiwan's missile-centric strategy may potentially have substantial inadvertent consequences.¹¹⁸ If Taiwan manages to successfully strike targets within the territorial boundaries of the PRC, then the PRC might have difficulty determining if such strikes originated from Taiwanese or US platforms. After all, the origin of offensive counterstrike weapons can be difficult to pinpoint.¹¹⁹ If the PRC were to mistake Taiwanese missile strikes for US missile strikes then corresponding attacks on US bases in Okinawa and Guam could occur. If the US were not planning to intervene, a PLA attack, even if by mistake, could necessitate US intervention in the conflict.

Aside from a variety of missiles, the October of 2020 arms sales also includes four armed MQ-9 Reaper drones.¹²⁰ Aerial drones have been at the top of the development and procurement lists of Taiwan's Ministry of National Defense since 2018.¹²¹ Similar to Taiwan's indigenous Teng Yun drone, the MQ-9 reaper can be used for reconnaissance operations. However, unlike the Teng Yun, the MQ-9 carries a variety of weapons including laser-guided bombs and

¹¹⁶ Chuanren, C. (2020, October 22). U.S. Approves SLAM-ER and MS-110 Pods for Taiwan. *Aviation International News Online*. Retrieved from

<https://www.ainonline.com/aviation-news/defense/2020-10-22/us-approves-slam-er-and-ms-110-pods-taiwan>

¹¹⁷ Girard, B. (2020, October 30). With New Offensive Weapons Package, Trump Administration Goes All-in for Taiwan. *The Diplomat*.

¹¹⁸ Murray, William S. (2008) "Revisiting Taiwan's Defense Strategy," *Naval War College Review*: Vol. 61 : No. 3 , Article 3. 15.

¹¹⁹ Ibid 15.

¹²⁰ US Approves Sale of Four Armed MQ-9 Reaper Drones to Taiwan. (2020, November 5). *The Straits Times*.

¹²¹ Tzeng, Y. (2019). *Prospect for Artificial Intelligence in Taiwan's Defense*. Jewish Policy Center.

air-to-ground missiles. Taiwan may elect to use the MQ-9 in a defensive manner to attack PLA vessels as they approach Taiwan's invasion beaches.

If Taiwan's military fails to destroy the PLA's force at sea, the next option is to prevent the PLA from successfully landing and maintaining forces on Taiwan's main island.¹²² As PLA naval vessels near the end of their cross-Strait voyage, Taiwan's surviving army units would come out of their bunkers to engage the PLA at the invasion beaches.¹²³ Even at this stage, missiles would play a consequential role. Taiwan hopes that its US-made FGM-148 Javelin anti-tank missiles purchased during the Obama Administration would be able to eliminate PLA amphibious tanks before they are able to move inland.¹²⁴ The FGM-148 Javelin is a semi-autonomous missile that requires no human intervention once fired. Similar to Taiwan's indigenous HF-2E, Yun Feng, and HF-3, the FGM-148 Javelin is equipped with an imaging infrared seeker that makes it exceptionally accurate.

Taiwanese combat engineers have spent decades constructing tunnels and elaborate underground facilities in the vicinity of potential invasion beaches, allowing Taiwan's military to store supplies in critical areas.¹²⁵ Nonetheless, Taiwan's defense at the water's edge may utilize AI to improve supply lines. In the event major roadways, bridges, and tunnels around Taiwan are destroyed by PLA bombs and missiles, unmanned drones like the Teng Yun could be used to supply soldiers in untraversable areas and conflict zones that are too hazardous for conventional vehicles. Although Taiwan's offshore islands are not the number one defense priority, unmanned

¹²² Gatchel, T. L. (1996). *At the Water's Edge: Defending Against the Modern Amphibious Assault*. Annapolis, Maryland: Naval Institute Press. 3.

¹²³ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 219.

¹²⁴ Department of Defense. (2016). 36(b)(1) Arms Sales Notification. *Federal Register of the National Archives and Records Administration*, 81(FR). 7522-7524.

¹²⁵ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 185.

drones or underwater submersibles could potentially be used to deliver much-needed supplies there as well.

Phase Three: Homeland Defense

If the PLA is able to establish and maintain a foothold on Taiwan's main island, then it will mark the beginning of the end of Taiwan's autonomy. Although it would not be an immediate game over scenario for Taiwan, its chances of survival would largely depend upon two factors: (1) Taiwan's ability to wage a prolonged guerrilla conflict; and (2) whether or not foreign intervention materializes. If deemed necessary, Taiwanese units could fall back into the mountains of eastern Taiwan to fight a prolonged series of counterattacks.¹²⁶

During the Vietnam War, the North Vietnamese were able to wage a long-duration guerrilla conflict in part because their supply lines were never entirely severed. Vietnam bordered other countries and the Ho Chi Minh trail allowed for a steady supply line.¹²⁷ Taiwan, on the other hand, is an island so it would be difficult to maintain supply lines in the event the PLA established a blockade. Taiwanese units who attempt to wage a drawn-out conflict in the mountains may eventually run out of supplies. However, vast reserves of supplies in underground and hidden facilities may be enough to keep the fight going for some time. Taiwan hopes that either its armed forces or significant US intervention would be able to prevent the PLA from making it to this point. It is difficult to know exactly what role AI could play at this stage but AI might play a role in providing supplies to Taiwanese guerrillas. Similar to how drug traffickers use narco-submarines to evade the Drug Enforcement Administration, unmanned submersibles full of supplies could potentially be used to evade the PRC blockade and thus provide Taiwanese guerrillas with supplies.

¹²⁶ Ibid 201.

¹²⁷ Arreguin-Toft, I. (2008). *How the Weak Win Wars: A Theory of Asymmetric Conflict*. Cambridge, England: Cambridge University Press. 166-168.

Recommendations

Table 5: Recommendations
1. Taiwan should procure and develop more land-based missiles to strengthen its counterattack capabilities.
2. Taiwan should expand upon its arsenal of unmanned drones (aerial and others) to augment its supply line.
3. Taiwan should consider acquiring smart sea mines to decrease its reliance on conventional immobile sea mines and thus minimize gaps in coverage.
The following paragraphs will explain in greater detail the reasoning behind these recommendations.

Taiwan is unlikely to launch its missiles before the PLA does.¹²⁸ Since it only takes the average PLA missile seven minutes to reach Taiwan, missiles aboard Taiwanese naval vessels and aircraft might get obliterated before they can be launched.¹²⁹ Taiwan's development of the land-based HF-2E, Yun Feng, and HF-3 missiles, as well as its procurement of US-made land-based Harpoon and MGM-168 missiles, are steps in the right direction. Taiwan should continue to develop and procure additional land-based missiles because they have a much greater chance of surviving PLA bombardment. Although land-based missiles may not be enough to deter a conflict from occurring, they greatly expand Taiwan's counterattack options and will most likely prolong the conflict.¹³⁰ If Taiwan continues to expand its missile-centric asymmetric strategy, then it will possess enough firepower to eliminate a significant number of PLA naval vessels before they reach the beaches of Taiwan.

Taiwan's procurement of US-made MQ-9 Reaper drones and its development of the Teng Yun drone are also wise decisions. Taiwan could enhance its missile-centric strategy by

¹²⁸ Murray, William S. (2008) "Revisiting Taiwan's Defense Strategy," *Naval War College Review*: Vol. 61 : No. 3 , Article 3. 15.

¹²⁹ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 219.

¹³⁰ Murray, William S. (2008) "Revisiting Taiwan's Defense Strategy," *Naval War College Review*: Vol. 61 : No. 3 , Article 3. 15.

expanding upon its arsenal of unmanned vehicles (i.e. aerial drones and others). In fact, it seems Taiwan may already be moving in this direction. Taiwan's development of unmanned vehicles reached the point that its Legislative Yuan passed "Unmanned Platform Technology Innovation Experiment" regulations in November of 2018 to allow for increased testing of drones and other unmanned vehicles.¹³¹ Taiwan's legislators claim this regulation is the first in the world that encompasses unmanned vehicles in the air, on the ground, and in the sea.¹³² Although Taiwan possesses immense stockpiles of supplies, they may be of little use if Taiwanese soldiers at the invasion beaches are unable to access them. PLA bombardment will most likely render most of Taiwan's transportation networks useless.¹³³ Various different types of drones, whether they be aerial, ground-based, or sea-based, could be used to augment Taiwan's supply line. Automated ground resupply could help Taiwan address its demands for logistical and medical support.¹³⁴ In general, advances in robotics and AI for logistics can improve the survivability of Taiwanese units under battle conditions over extended periods of time. Taiwan can stay in the fight for a longer period of time if it is able to prevent its soldiers from running out of supplies.

One shortcoming of Taiwan's defense strategy is its assumption that the PLA's amphibious landings would occur only on the fourteen beaches Taiwan thinks are most suitable for amphibious landings. This mindset is eerily reminiscent of France's Maginot Line during World War II where France built robust gun emplacements throughout its border with Germany but left its border with Belgium largely undefended. The Germans simply invaded Belgium to bypass the majority of France's static defensive positions.¹³⁵ Although it might not be possible

¹³¹ Tzeng, Y. (2019). *Prospect for Artificial Intelligence in Taiwan's Defense*. Jewish Policy Center.

¹³² Ibid.

¹³³ Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books. 110.

¹³⁴ Konaev, M. (2019, October 29). With AI, We'll See Faster Fights, But Longer Wars. *War on the Rocks*. University of Texas at Austin.

¹³⁵ Gatchel, T. L. (1996). *At the Water's Edge: Defending Against the Modern Amphibious Assault*. Annapolis, Maryland: Naval Institute Press. 33.

for Taiwan's military to be everywhere at once, Taiwan must improve its mobile ground defense in case the PLA attempts an amphibious landing at an unsuspected area.

Traditional military thinking suggests naval forces have greater mobility than ground forces.¹³⁶ It would be difficult for Taiwanese units to set up gun emplacements on a whim. Fortunately for Taiwan, there is an alternative option. Smart sea mines could pose an enormous threat to PLA naval vessels nearing Taiwan's main island. The distinguishing factor between a smart sea mine and an ordinary sea mine is its ability to use AI to differentiate one type of ship from another before detonating, as well as its ability to be mobile, rather than stationary.¹³⁷ If it seemed like a significant PLA amphibious landing was going to occur at an unsuspected beach, then smart sea mines could change their positions to address the threat. If deployed in ample numbers, smart sea mines could minimize gaps in coverage, thus complicating PLA efforts to land troops and supplies on Taiwan's main island.

Conclusion

Formulating a defense strategy to thwart an amphibious invasion by the PLA is an onerous task. Taiwan's disputed status is unlikely to change in the foreseeable future and it will remain a point of contention in US-PRC relations for years to come. The rise of the PRC will continue to challenge Taiwan's security in every conceivable way. Although there is a substantial power imbalance across the Taiwan Strait, Taiwan's emphasis on force multipliers like asymmetric strategy and AI have bolstered its defensive capabilities.

Despite the significant vulnerabilities associated with offensive amphibious landings, most of them conducted by Allied forces during World War II were successful. The architect of the Soviet Union's navy, Admiral Sergei Gorshkov, noted that during the war, "no amphibious

¹³⁶ Ibid 21-22.

¹³⁷ O'Hanlon, M. E. (2018, November 29). The Role of AI in Future Warfare. *Brookings Institution*.

operation was subject to continuous disruption from point of assembly to the landing itself.”¹³⁸

Taiwan’s missile-centric asymmetric strategy will attempt to cause disruption at the PLA’s various points of assembly on the PRC coast, as well as at sea and on Taiwan’s beaches.

Although a great number of Taiwan’s missile strikes may be unsuccessful, Taiwan has certainly put in a concerted effort to wreak havoc. Ultimately, Taiwan’s arsenal of asymmetric weapons is its greatest defense aside from the prospect of US intervention.

If Taiwan continues to expand upon its arsenal of AI-assisted asymmetric weapons like missiles, drones, and mines then it may be able to destroy a substantial number of PLA vessels before they reach Taiwan’s main island. The more PLA vessels eliminated, the more difficult it will be for the PLA to end seven decades of self-rule in Taiwan. At the minimum, Taiwan’s use of AI and asymmetric strategy will prolong the conflict. Should the PRC’s integrated air defense system prove to be less formidable than currently thought, then Taiwan’s missile-centric asymmetric strategy might convince the US that the Battle for Taiwan is far from a lost cause. If enough PLA vessels are destroyed and the PLA is unable to maintain and resupply an invasion force on Taiwan’s main island then a long-term conflict might become inevitable.

Works Cited

Arreguin-Toft, I. (2008). *How the Weak Win Wars: A Theory of Asymmetric Conflict*.

Cambridge, England: Cambridge University Press.

Aspinwall, N. (2020, January 3). Taiwan Passes Anti-Infiltration Act Ahead of election

Amid Opposition Protests. *The Diplomat*.

Axe, D. (2020, July 17). If China Invades, Taiwan Could Target Shanghai and Beijing

With Cruise Missiles. *Forbes*.

¹³⁸ Gatchel, T. L. (1996). *At the Water's Edge: Defending Against the Modern Amphibious Assault*. Annapolis, Maryland: Naval Institute Press. 2.

Axe, D. (2020, July 10). The Taiwanese Island Fortress That Could Halt A Chinese Invasion. *Forbes*.

Baron, J. (2020, August 18). The Glorious Contradictions of Lee Teng-hui. *The Diplomat*.

Bosco, J. (2015, May 15). Taiwan and Strategic Security. *The Diplomat*.

Chan, M. (2019, March 10). Beijing 'won't allow Taiwan reunification to be postponed indefinitely'. *South China Morning Post*.

Chase, M., Engstrom, J., Tai Ming Cheung, Gunness, K., Harold, S., Puska, S., & Berkowitz, S. (2015). Missions of the People's Liberation Army. In *China's Incomplete Military Transformation: Assessing the Weaknesses of the People's Liberation Army (PLA)*. Santa Monica, CA.: RAND.

Chuanren, C. (2020, October 22). U.S. Approves SLAM-ER and MS-110 Pods for Taiwan. *Aviation International News Online*. Retrieved from <https://www.ainonline.com/aviation-news/defense/2020-10-22/us-approves-slam-er-and-ms-110-pods-taiwan>

Chung, L. (2019, June 25). Taiwan's Next-Generation Formosat 7 Satellite Blasts off from Kennedy Space Center. *South China Morning Post*.

Chung, L. (2019, November 25). DPP to Introduce Anti-Infiltration Bill. *Taipei Times*.

Chung, L. (2019, October 30). Taiwan Charges Pro-Beijing Politicians with Accepting Funds from Chinese Mainland. *South China Morning Post*.

Chung, L., & Huang, K. (2020, October 28). Latest US Arms Sale to Taiwan 'Will Help Destroy Half of Any Chinese Invasion Force'. *South China Morning Post*.

Cole, J. M. (2015, August 13). Taiwan Unveils New Long-Endurance Drone, New Weapons at Defense Trade Show. *The Diplomat*.

Defense Security Cooperation Agency, Department of Defense. (2020, October 26). *Taipei Economic and Cultural Representative Office in the United States (TECRO) - RGM-84L-4 Harpoon Surface Launched Block II Missiles*[Press release].

Del Monte, L. (2018). *Genius Weapons: Artificial Intelligence, Autonomous Weaponry, and the Future of Warfare*. Amherst, New York: Prometheus Books.

Department of Defense. (2016). 36(b)(1) Arms Sales Notification. *Federal Register of the National Archives and Records Administration*, 81(FR). 7522-7524.

Easton, I. (2019, October 25). Is It Possible to Stop China from Seizing Taiwan? *The National Interest*.

Easton, I. (2019). *The Chinese Invasion Threat: Taiwan's Defense and American Strategy in Asia*. Manchester: Eastbridge Books.

Gatchel, T. L. (1996). *At the Water's Edge: Defending Against the Modern Amphibious Assault*. Annapolis, Maryland: Naval Institute Press.

Girard, B. (2020, October 30). With New Offensive Weapons Package, Trump Administration Goes All-in for Taiwan. *The Diplomat*.

Greer, T. (2019, September 17). Taiwan's Defense Strategy Doesn't Make Military Sense. *Foreign Affairs*.

Greer, T. (2018, September 25). Taiwan Can Win a War With China. *Foreign Policy*.

Heath, T. R., (2017). Chinese Political and Military Thinking Regarding Taiwan and East and South China Seas. Santa Monica, CA. *RAND*.

- Heginbotham, E., Nixon, M., Morgan, F. E., Heim, J. L., Hagen, J., Li, S. T., . . . Morris, L. J. (2015). *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996 - 2017*. Santa Monica, CA: RAND.
- Horowitz, M. (2018). Artificial Intelligence, International Competition, and the Balance of Power. *Texas National Security Review*, 1(3).
- H.R.2479-Taiwan Relations Act, 96th Congress. (1979) (enacted).
- Jennings, R. (2018, August 18). Taiwan Steps Up Production of Missiles to Create Asymmetric Advantage Over China Military Build-Up. *The Associated Press*.
- Kamphausen, R., & Lai, D. (2015). *The Chinese People's Liberation Army in 2025*. Carlisle, Pennsylvania: Strategic Studies Institute and U.S. Army War College Press.
- Konaev, M. (2019, October 29). With AI, We'll See Faster Fights, But Longer Wars. *War on the Rocks*. University of Texas at Austin.
- Liu, X. (2009). *Air Defense and Space Defense Information Systems and Their Integrated Technologies* [防空防天信息系统及其一体化技术]. **Beijing National Defense Industry Press**.
- Lostumbo, M. J., Frelinger, D. R., Williams, J., & Wilson, B. (2016). *Air Defense Options for Taiwan: An Assessment of Relative Costs and Operational Benefits*. Santa Monica, CA: RAND.
- Mathews, J. (1979, January 1). China, in Signal To Taiwan, Ends Island Shelling. *The Washington Post*.
- Mei, F.S. (2006, June 19). Medium Range Air Defense Radar. *Taiwan Defense Review*.

Morgan, F. E., Boudreaux, B., Lohn, A. J., Ashby, M., Curriden, C., Klima, K., & Grossman, D. (2020). *Military Applications of Artificial Intelligence: Ethical Concerns in an Uncertain World*. Santa Monica, CA: RAND. 20.

Murray, William S. (2008) "Revisiting Taiwan's Defense Strategy," *Naval War College Review*: Vol. 61 : No. 3 , Article 3.

O'Hanlon, M. E. (2018, November 29). The Role of AI in Future Warfare. *Brookings Institution*.

Pan, J. (2017, May 11). Second Suspect Investigated in Spy Case. *Taipei Times*.

Pike, J. (2014, March 9). Sky Bow III / Tien Kung III. *GlobalSecurity.org*

Scharre, P. (2019). *Army of None: Autonomous Weapons and the Future of War*. New York, NY: WW Norton & Company. 16.

Shlapak, D. A., Orletsky, D. T., & Wilson, B. A. (2000). *Dire Strait? Military Aspects of the China-Taiwan Confrontation and Options for U.S. Policy*. Santa Monica, CA: RAND.

Thompson, D. (2018, October 2). Hope on the Horizon: Taiwan's Radical New Defense Concept. *War on the Rocks*. University of Texas at Austin.

Tyler, P. E. (1996, March 18). China Warns U.S. to Keep Away From Taiwan Strait. *The New York Times*.

Tzeng, Y. (2019). *Prospect for Artificial Intelligence in Taiwan's Defense*. Jewish Policy Center.

US Approves Sale of Four Armed MQ-9 Reaper Drones to Taiwan. (2020, November 5). *The Straits Times*.

Wong, K. (2019, August 19). Taiwan's NCSIST Unveils New MALE-class UAV Development. *Jane Defence Weekly*.

(2015, June). Missiles of Taiwan. *Nuclear Threat Initiative*. Retrieved from <https://www.nti.org/learn/countries/taiwan/delivery-systems/>

(2019, September 7). Artificial Intelligence is Changing Every Aspect of War. *The Economist*.