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China's Relations with Taiwan and North Korea
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Asymmetric Options for Taiwan's Defense[1]

Introduction

An armed conflict between China and Taiwan remains possible despite the past six years' improvements in cross-Strait relations. China's military, which two decades ago essentially had no real capability to coerce Taiwan is now much more powerful both in absolute terms and relative to Taiwan, and continues a modernization program that is stunning in its rapidity and comprehensiveness. For China, Taiwan is nearly the foremost "core interest" over which it is unwilling to comprise, yet is willing to fight.[2] Little good can be said about the likely effects of such a conflict. A best case in which fighting was limited and quickly ended would deepen and harden wariness and mistrust of China in many East Asian states, and likely cause renewed arms races, exacerbated security dilemmas, and bad effects on regional stability and trade. A longer war involving other Asian powers and potentially the United States would be commensurately worse, and could conceivably escalate to use of nuclear weapons.

How might such grim outcomes be avoided? Some propose that the United States withdraw military support from Taiwan. Such an action, one advocate writes, "would remove the most obvious and contentious flash point between the United States and China and smooth the way for better relations between them in the decades to come."[3] Whatever the merits of this prediction (and there is no informed

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[2] Michael D. Swaine, "China's Assertive Behavior, Part One: On "Core Interests," *China Leadership Monitor*, No. 34, Winter, 2011, http://www.carnegieendowment.org/2010/11/15/china-s-assertive-behavior-part-one-on-core-interests/73.

[3] Charles Glaser, "Will China's Rise Lead to War? Why Realism Does Not Mean Pessimism," *Foreign Affairs*, March/April 2011. See also Bill Owens, "America must start treating China as a friend," *Financial Times*, November 17, 2009, http://www.ft.com/intl/cms/s/0/69241506-d3b2-11de-8caf-00144feabdc0.html#axzz1RXebUtOH.

consensus on this),[4] achieving it would require a significant change to longstanding U.S. Taiwan policy. Without a dramatic forcing function or crisis, such a change seems unlikely.

A sharply different approach is implicit in the Pentagon's new Air Sea Battle concept, which seeks to enable the US to overcome Anti-Access/Area Denial forces of the sort China has been fielding.[5] Official sources claim that Air Sea Battle is not aimed at China. However, if the US were able to overcome Chinese A2AD, it could then rapidly defeat People's Liberation Army (PLA) forces that threatened Taiwan.

The highly-advanced conventional striking forces needed for ASB might form an effective deterrent. However, the US would have to overcome serious challenges to make such a force credible. These difficulties include the prospect of helping Taiwan despite short warning, the irreducibly-long distances over which US reinforcements would have to travel, questionable allied participation and support, and the considerable difficulties involved in overcoming China's defenses. These challenges, and doubts about the willingness of the United States to engage in a war with China over Taiwan brings into question Air Sea Battle's deterrent value.

Nonetheless, some powerful interest groups would pursue this alternative. For example, the U.S. Air Force (USAF) wants to build up to 100 new Long Range Strike-Bombers optimized to defeat challenges such as those posed by China. This new plane "will carry precision-guided conventional weapons and nuclear weapons. It will be optionally manned, providing operational flexibility when planning missions of long duration or in challenging anti-access environments."[6] The USAF estimates it can build this plane for a 2010 unit cost of $550 million,[7] but the final cost is likely to be higher. As a point of comparison, the USAF paid $44.7 billion 1997 dollars for 21 B-2 stealth bombers.[8]

As indicated by the new bomber, implementing ASB would involve a wide range of costly investments. Table 1 lists some of the weapons that a 2010 Center for Strategic and Budgetary Assessments paper

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[4] See, for example, Nancy Bernkopf Tucker and Bonnie Glaser, "Should the United States Abandon Taiwan?" *The Washington Quarterly*, vol. 34, no. 4, Fall 2011, pp. 23-37. http://csis.org/files/publication/twq11autumntuckerglaser.pdf.

[5] "Anti-access refers to those actions and capabilities, usually long-range, designed to prevent an opposing force from entering an operational area. Area denial refers to those actions and capabilities, usually of shorter range, designed not to keep an opposing force out, but to limit its freedom of action within the operational area." See the See the Joint Operational Access Concept, Version 1.0, United Stated Department of Defense, 17 January, 2012, p. i, http://www.defense.gov/pubs/pdfs/JOAC_Jan%202012_Signed.pdf

[6] Philip Ewing, "United States Air Force The Air Force's Simple, No-frills, Advanced New Bomber," *DoD Buzz*, 13 February, 2012, http://www.dodbuzz.com/2012/02/13/the-air-forces-simple-no-frills-advanced-new-bomber/.

[7] Ibid.

[8] See, "B-2 Bomber Cost and Operational Issues," General Accounting Office Report GAO/NSIAD-97-181, August 1997, http://www.gao.gov/archive/1997/ns97181.pdf.

described as beneficial Air Sea Battle forces[9] and includes estimated unit costs of analogous weapons systems. Some systems useful for ASB probably should be bought in some numbers as part of normal military modernization, even if not to deter or fight China. Yet the magnitude of the costs the systems recommended by ASB advocates will probably preclude their acquisition. We should look for alternatives that can deter Chinese aggression.

One such option involves steps Taiwan can take regardless of U.S. action, to improve its defenses. Taipei faces the prospect (either singularly or in combination) of being subjected to a Chinese bombardment, a blockade,[10] or an invasion. Taiwan's air force and navy can no longer counter these threats, so Taipei ought to aggressively develop and field "asymmetrical forces," such as I first described in a 2008 paper.[11]

The key attributes of such forces would be:

- low costs relative to the Chinese forces they oppose;
- an ability to ride out a Chinese precision-munitions bombardment;
- and high effectiveness against Chinese forces attempting to blockade or invade Taiwan.[12]

These weapons would survive by virtue of mobility, redundancy, hardening, deception, and large inventories made possibly by low relative costs. These attributes would make Taiwan's defense difficult for China to overcome with long range precision strike weapons, and thereby make Taiwan far less susceptible to early defeat.

Transforming Taiwan's military into such a survivable and lethal anti-force would:

- offset much of China's force modernization by rendering specific classes of PRC ships and aircraft vulnerable to purpose-built Taiwan weapons;
- increase crisis stability by assuring Taiwan that, even if alone, it could withstand Chinese attack for extended periods;
- reduce the need for immediate US intervention and increase the probability that diplomatic pressure would persuade China to end its attack;
- provide the US more time to determine if intervention was necessary, and if so, to intervene in a measured, methodical way that played to US strengths;
- enhance cross-Strait deterrence by making Chinese victory more uncertain;

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[9] Jan van Tol, Mark Gunzinger, Andrew Krepinevich, and Jim Thomas, "AirSea Battle: A Point-of-Departure Operational Concept," Center for Strategic and Budgetary Analysis, 18 May 2010, www.csbaonline.org/publications/2010/05/airsea-battle-concept.

[10] Although a Chinese blockade of Taiwan would probably entail the use of submarines as a means of enforcing a maritime quarantine, this paper focuses on the surface and air aspects of such a conflict.

[11] William S. Murray, "Revisiting Taiwan's Defense Strategy," *US Naval War College Rev*iew, Vol. 61, No. 3, Summer 2008, pp. 12-38.

[12] As opposed to being US-styled, distantly deployable general purpose forces.

- prove more affordable to Taiwan than are current big-ticket, symmetrical weapons systems like F-16 fighters, warships, and ballistic missile defenses
- shift the financial burden of deterring a Chinese attack from the United States to Taiwan.

Many of the weapons systems appropriate for such a Taiwan force are unambiguously defensive and would therefore comply with the Taiwan Relations Act if made available to Taiwan by the United States. On the other hand, many of the weapons systems I recommend embody relatively simple technology. Taiwan could probably develop and manufacture many of them with little or no U.S. help.

I believe that Taiwan's democracy is worth preserving. If U.S. and Taiwan policymakers agree, they need a new military response to China's Taiwan-centric buildup. This new response must also account for Taiwan domestic politics, which have in recent years thwarted efforts to raise Taiwan's defense expenditures.[13] This paper offers workable solutions to address these realities.

China's Military Modernization: Taiwan at the Core

Although Taiwan's future status is not the only security concern facing China, it is the most significant of all Beijing's outstanding territorial and maritime claims. China has consequently devoted substantial effort to resolve the issue on Beijing's terms. According to a 2012 Department of Defense report, "the PLA continued to build the capabilities and develop the doctrine it considers necessary to deter Taiwan from declaring independence; to deter, delay, and deny effective U.S. intervention in a potential cross-Strait conflict; and to defeat Taiwan forces in the event of hostilities."[14] Ballistic and cruise missiles exemplify weapons systems that can readily be used to achieve likely Chinese coercive objectives regarding Taiwan.

Short-Range Ballistic Missiles vs. Taiwan's Air Force

Over the past decade, China has increased the size and improved the accuracy of its Short Range Ballistic Missile (SRBM) force. It has also developed a variety of warheads for these missiles, including apparently runway penetrating sub-munitions and unitary warheads.[15] In 2002 China had 350 SRBMs with an estimated accuracy, or Circular Error Probable (CEP) of approximately 300 meters.[16] By 2012

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[13] See Michael Chase, *Taiwan's Security Policy* (Boulder, CO: Lynn Rienner, 2008).

[14] "Annual Report to Congress, Military and Security Developments Involving the People's Republic of China 2012," *Office of the Secretary of Defense*, May 2012, p. iv. (Hereafter 2012 DoD Annual Report to Congress.)

[15] DoD's 2012 Annual Report to Congress states that "The PLA Second Artillery Corps is modernizing its short range ballistic missile force by fielding advanced variants with improved ranges and payloads." p. 7. Evidence of what appear to be runway penetrating submunitions can be seen from historical Digital Globe satellite imagery on Google Earth dated 6 March 2007 at 40°29' 19" N, 93° 30' 01" E, and from images dated 19 October 2011 and 20 August 2010 at 39° 09' 15" N, 88° 37' 21" E.

[16] The CEP is the radius of a circle into which half the warheads fired at a particular aimpoint will fall. The 350 SRBM figure is from the 2002 DoD annual report on the Military Power of the People's Republic of China, pg. 1. The 300 meter CEP estimate is from Michael O'Hanlon, "Why China Cannot Conquer Taiwan," *International Security* 25, no. 2 (Fall 2000), p. 58.

China had over 1,100 missiles deployed to units opposite Taiwan, with CEPs on the order of 20 meters.[17] This level of accuracy, increased inventory, and the targeting flexibility provided by multiple types of warheads means that SRBMS now provide China new options against Taiwan. For example, China can with little or no warning crater all of Taiwan's runways with SRBMs precisely delivering runway-penetrating warheads. With Taipei's fighter aircraft unable to take off and thereby "frozen" in place, subsequent SRBM and cruise missile attacks could destroy Taipei's grounded air force. A 2008 RAND study concluded that as few as 100 sufficiently accurate missiles could prevent all of Taiwan's air force from flying and destroy much of it on the ground.[18] Since China appears to have achieved a 20m CEP for its ballistic missiles, RAND's prediction is now probably a reality.

Taiwan could attempt to rapidly repair its runways by filling in and covering runway craters to allow aircraft protected in hardened shelters and tunnels to fly. This process, known as rapid runway repair, would likely be a losing battle since the repair of craters takes many hours, Taiwan has few runways, and China has many missiles.[19] Even if Taiwan's fighters could somehow get airborne, they would not long survive against the PLA's overwhelming numbers of 4th and 5th generation fighters or the PLA's land and sea-based long-range surface to air missiles (SAMs).[20]

Consequently, Taiwan's air force, even if it comprised of large numbers of modern fixed wing fighters, cannot be expected to make a meaningful wartime contribution to the defense of Taiwan since it won't be able to take off. As such, it can no longer be viewed as an effective deterrent. Taiwan must find an alternate means of defeating an invasion, countering a blockade, and contesting for air superiority if

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[17] The number of SRBMs and launchers is from DoD's 2012 Annual Report to Congress, p. 29. The estimated current SRBM CEP is based on Digital Globe satellite imagery of what appears (based on the size of craters and the distance to military airfields, thus making very unlikely artillery and air-delivered munitions) to be a PLA ballistic missile testing facility on Google Earth dated 24 September 2011, at 40°29' 29" N, 93° 30' 37" E. This, and corresponding historical satellite imagery of the same location, show multiple target buildings approximately 20 meters on an edge having been destroyed by what must logically be ballistic missile warheads. The destruction of other similarly sized targets nearby strongly corroborates a 20m CEP or better accuracy.

[18] David A. Shlapak, David T. Orletsky, Toy I. Reid, Murray Scot Tanner, Barry Wilson, "A Question of Balance: Political Context and Military Aspects of the China-Taiwan Dispute," *RAND*, Santa Monica CA, 2009, pg. 50. www.rand.org/pubs/monographs/2009/RAND_MG888.pdf.

[19] A brochure for a US-made runway repair kit states that a crater from a delayed fused, concrete-penetrating 45 kg warhead requires at least four hours and fourteen pieces of heavy earth-moving equipment to repair. China's CSS-7 SRBMs are thought to be able to deliver a 600 kg payload, and a RAND publication (Shlapak, et. al., "A Question of Balance," p. 39) estimates that sub-munitions can make up approximately 75% of an SRBM's effective payload. This suggests that a PLA SRBM could carry ten 45 kg submunitions that would require 40 hours of effort to repair. For more on combat runway repair, see "Airfield Damage Repair Operations, Air Force Pamphlet 10-219," Volume 4, 28 May 2008, http://www.e-publishing.af.mil/shared/media/epubs/AFPAM10-219V4.pdf. See also the Rapid Mat Group website, http://www.rapidmat.com/index-2.html.

[20] See for example, Shlapak,et.al, "A question of Balance," pp. 72-74, 85. Their analysis, which did not consider attrition of Taiwan aircraft from PRC naval SAMs, is very pessimistic regarding Taiwan's air force wartime survival and effectiveness.

cross-Strait deterrence is to be maintained and crisis stability enhanced. The Taiwan Navy would be a logical candidate for these missions.

Unfortunately however, Taiwan's Navy when in port is vulnerable to accurate PRC ballistic and missiles. A typical Taiwan warship is about 15 meters wide, which suggests that a salvo of two or three 20-meter-CEP SRBMs should have a high probability of hitting a naval vessel moored to a pier. Google Earth imagery of Taiwan's naval ports suggests that more than half of Taiwan's 26 destroyers and frigates are tied to piers on any given day.[21] This means that a surprise attack by a few dozen SRBMs could destroy the majority of Taiwan's large warships.[22]

Chinese SRBMs could likely not hit Taiwan warships at sea. But China has built large numbers of ASCM-carrying wave-piercing catamarans, frigates, and destroyers. All these ships, and most of China's older warships carry anywhere from 8 to 16 ASCMs that individually have ranges of at least 100 km. China also has an extensive inventory of land and air-launched ASCMs, to say nothing for now of the PLAN submarine force's arsenal of torpedoes and ASCMs.

Observers can speculate how effectively China's ASCMs (whether delivered via ship, or by aircraft) and the targeting system necessary to direct their accurate launch would perform against Taiwan's surface warships. Taiwan could attempt to defeat China's ASCMs by a combination of hard-kill defenses such as the SM-2 SAMs fired from Taiwan's 4 ex-USS Kidd class air defense destroyers. Soft kill measures such as electronic attack, decoys, or the employment of radar and visual obscurants can also defeat ASCMs by luring the missiles away from their targets. Such measures will likely allow Taiwan's naval forces to survive a few attacks, but Beijing has a marked numerical superiority allowing it to either whittle away or subject Taipei's navy to an overwhelming mass attack. In this competition Taiwan has to achieve perfect performance, whereas China can afford to frequently miss, so long as eventually it gets hits. This imbalance substantially favors China, leaving little room for optimism regarding Taiwan's navy's ultimate fate. Large numbers of ASCMs employed in a vicious, probably short campaign of attrition will annihilate Taiwan's navy, at acceptable cost to the PLA.

This outcome is especially likely in a scenario of a bombardment preceding an amphibious invasion, wherein Taipei's navy would have to operate for extended periods near the area being invaded. The likelihood of destruction in a counter-blockade scenario is less certain, but replenishing and rearming Taiwan's surface combatants (which only carry a handful of anti-ship weapons) would be a vexing problem since the requisite logistics ships and infrastructure would likely be high on China's target list. Meanwhile, Chinese naval and aerial forces would benefit from intact or nearly intact support

[21] Taiwan also has approximately 43 missile patrol craft that would probably be more difficult for China to target and destroy.

[22] This assessment is derived from combat results. Specifically, no warship struck by a 165 kg warhead delivered by a subsonic EXOCET anti-ship cruise missile has retained the ability to perform its mission. HMS Sheffield was sunk and HMS Glamorgan badly damaged by single Exocet ASCMs during the 1982 Falklands War. USS Stark (FFG 31) nearly sank after being hit by two Iraqi Exocet ASCMs in 1987 and Israel's Ahi Hanit in 2006 retired from battle after being struck by a subsonic, Chinese-made C-802 ASCM, which also has a 165 kg warhead. China's SRBMs can carry a 600 kg warhead, and travel at supersonic speeds. This combination of explosive and kinetic energy would likely destroy any Taiwan warship.

infrastructure. Consequently, it appears doubtful that Taiwan's large surface combatants (like Taiwan's air force) would be a viable or effective means of breaking a blockade or sinking an armada of invading amphibious ships.

SRBMs vs. ballistic missile defenses

In my 2008 paper, I argued that that Taiwan's Patriot missiles could neither prevent nor greatly reduce the damage inflicted by SRBMs. Even so, Taiwan already has many Patriot missile interceptors, and the U.S. has offered to make more available.[23] A further expansion of Taiwan's Patriot inventory, however, would probably prove expensive and offer limited combat utility. The combined costs of 1992, 2007, 2008, and 2012 Patriot sales total over $8.1 billion.[24] Taiwan's annual defense budget over the past decade has averaged $8.7 billion, which means that Patriots cumulatively represent an average annual Taiwan defense budget.[25] Such an expensive system ought to have a corresponding combat payoff, but even if Taiwan's Patriots performed as well as could be expected these missiles will likely stop no more than 323 of the 1,200 SRBMs China could fire.[26, 27]

This arms race between Chinese SRBMs and Taiwan's Patriot interceptors is thus one Taiwan cannot win, and cannot afford to continue.[28]

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[23] See Rich Chang, "PAC-3s Will Protect Taiwan, MND Says," Taipei Times, 21 March 2005, p. 3, available at http://www.taipeitimes.com/News/taiwan/archives/2005/03/21/2003247172. For a detailed discussion of the Taiwan's efforts to purchase PAC 3s, see Shirley Kan, "Taiwan: Major U.S. Arms Sales Since 1990," *Congressional Research Service*, 3 March 2014, pp. 16-17.

[24] Shirley Kan, "Taiwan: Major U.S. Arms Sales" pp. 58-59.

[25] Shirley Kan, "Taiwan: Major U.S. Arms Sales" p. 34.

[26] Taiwan's Patriot interceptors might intercept and destroy a maximum of 644 (200 PAC-2 plus eventually 444 PAC-3) of the 1,200 SRBMs China could fire. However, actual intercepts will almost certainly be much lower. Accepted firing doctrine suggests that two interceptors will be fired at each incoming missile that threatens a valuable target, thereby halving the potential intercepts to 322. This level of defense would allow at best the 323rd and all subsequently-fired SRBMs to strike their targets. This number, however, is probably optimistic since the Patriot batteries themselves including especially the AN/MPQ-56 radar sets (without which the rest of the Patriot system is useless) are subject to direct attack by the PLA's 10-meter-CEP DH-10 land attack cruise missiles, Harpy and other homing anti-radiation weapons, or by other means.

[27] Data indicates that Taiwan spent $8.1 billion on 644 interceptors. Each interceptor therefore has a net cost (including all ancillary equipment, and before offsets are subtracted) of over $12 million, implying a cost per SRBM intercept of up to $24 million. Personal discussions with Raytheon representatives (the maker of Patriots) however, indicate each PAC-3 interceptor costs about $3million. Whatever the precise number, this remains an expensive approach to defending against a SRBM bombardment.

[28] Taiwan's PATRIOT interceptors could, however be very effective as a mean of denying China air superiority, especially if operated in tandem with short-range air defenses, and in a highly mobile, "shoot-and-scoot" manner, as will be described shortly.

The net result of all these factors is that Taiwan has at best limited ability to prevent Chinese SRBMs from quickly destroying in the opening hours and days of a war fixed military targets including runways, moored ships, communications and command centers, critical radars, unhardened fuel and ammunition depots, and so on.[29] Despite enormous investments in active ballistic missile defenses, Taiwan cannot prevent this. It must therefore instead adjust its force structure and disposition to be able to withstand a SRBM-bombardment. This implies that Taiwan should harden what it cannot make mobile, invest in high-fidelity decoys, and build redundancy wherever necessity allows and feasibility permits. In many ways, this is taking a page from the PLA playbook, albeit with higher intensity given Taiwan's fewer alternatives and lesser strategic depth.

Developing Taiwan's Anti-Access/Area Denial Force – Learn from China

Taiwan's air force and much of its navy are likely no longer survivable during wartime. Yet Taipei needs the capacity to ride out bombardment, withstand a blockade, and to repel an invading amphibious fleet.[30] In short, Taiwan needs to develop its own anti-access and area-denial forces.

Ironically, China provides examples of how to hold a determined, powerful adversary at bay. For example, China has developed and paraded in Beijing large numbers of truck-mounted, several hundred-km range YJ-62 ASCMs.[31] Similar, (if shorter ranged), independently targetable truck mounted anti-ship cruise missiles—known as coastal defense cruise missiles (CDCMs), would help Taiwan prevent a Chinese invasion or counter a close blockade.[32] Such systems' mobility confers several important advantages. CDCMs can be dispersed and hidden among commercial fleets of similarly sized trucks, inside or behind large buildings, underneath overpasses, bridges or trees, inside tunnels, or protected inside hardened prepared firing positions, and then driven to firing locations near an amphibious landing. China would be hard-pressed to locate and positively identify such ASCM-carrying trucks, each of which, given adequate targeting data (described below) could independently destroy PLAN warships. This would call into question the ultimate success of the invasion or blockade.

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[29] A Chinese bombardment of Taiwan might also target civilian infrastructure including electrical power distribution facilities, liquid natural gas offloading terminals, communication centers, or even water treatment facilities. This suggests that anti-bombardment should also be addressed through civil preparedness, which aligns well with the need for Taiwan to prepare for earthquakes and typhoons. Such initiatives could build on existing approaches, which include monthly air raid drills in Taipei.

[30] See James Holmes and Toshi Yoshihara, "Taiwan's Navy: Still in Command of the Sea?" Jamestown Foundation *China Brief* Vol. 10 Issue 6, 18 March 2010, http://www.jamestown.org/single/?no_cache=1&tx_ttnews%5Btt_news%5D=36167.

[31] I am unaware of an authoritative estimate of this missile's range; however its large size and inlet for a turbofan or turbojet engine imply an extended range, on the order of magnitude of at least several hundred kilometers.

[32] Examples of truck mounted CDCMs systems that Iran – which in some ways has defensive requirements similar to Taiwan - is fielding can be seen on a U-tube video entitled "New missile systems join Iran Navy-Sahar Urdu News 03-01-11 Tehran," which can be viewed at http://www.youtube.com/watch?v=gsL76WJUkKw&feature=related. Taiwan has reportedly already fielded some truck-mounted coastal defense truck-mounted cruise missiles, but the concept has sufficient promise to warrant increased investment and reliance.

Chinese efforts to defeat CDCMs would encounter the same sort of problems the United States faced when it unsuccessfully hunted SCUDs in the Western Iraqi desert in 1992,[33] and in its operationally unsuccessful effort to find and destroy Serbian mobile SAM systems and tanks in Kosovo seven years later.[34] Simply stated, even for technologically advanced powers enjoying air superiority, it was and likely remains extremely difficult to find, positively identify, and destroy small mobile targets. Taiwan can, and should aggressively exploit this enduring imbalance between attacker and defender.

Taiwan would have to know where to aim its CDCMs. This targeting data could be provided by low-powered or commercial radars on the CDCM trucks, by radars mounted on other trucks, by fully-passive systems that can detect and provide bearings to warships' electronic emissions,[35] or even from small, inexpensive UAVs similar to the United States' Scan Eagle.[36] This mode of independent forces conducting their own targeting and employment would require a high degree of professionalism and the decentralized control of Taiwan's forces. Taiwan's military is already widely regarded for its professionalism, and therefore should certainly be able to develop and inculcate the doctrine necessary for effective decentralized execution.

A robust force of Taiwan CDCMs could threaten any PLAN vessels operating within dozens of miles of Taiwan, and would force Beijing to develop a costly program of hard- and soft-kill self-defensive countermeasures. Above all, adoption of this approach would result in China being placed on the "body" end of a "bullet-vs.-body" conflict. In this competition, Taiwan has only relatively inexpensive munitions at risk, whereas each hit kills a Chinese "body," i.e. an expensive ship.[37] Taipei, perhaps assisted by other powers, can make this competition even more burdensome for Beijing by fielding over time improvements such as evolved seeker technologies and terminal maneuvers. This is an arms race, and a form of deterrence, Taiwan can both afford, and win.

Large Numbers of Fast, Small, ASCM-equipped vessels and mines – Learn from Iran

Taiwan could gain a similar advantage by increasing the number of ASCMs it can deploy via high speed fast attack craft (FAC). Taiwan's fleet of thirty 33 knot, 170-ton *Kuang Hua* missile patrol craft are said to carry four Hsiungfeng II ASCMS, and Taiwan recently unveiled the first of a proposed new class of

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[33] The U.S. devoted some 2,500 sorties to what became known as the SCUD Hunt, "but it did not score one confirmable kill against a mobile missile or its launcher in Iraq." Mark Thompson, Azadeh Moaveni, Matt Rees, and Aharon Klein, "Iraq: The Great Scud Hunt," *Time*, December 23, 2002, http://www.time.com/time/magazine/article/0,9171,1003916,00.html#ixzz21eeXO4Vj.

[34] Carlo Kopp, "Surface to Air Missile Effectiveness in Past Conflicts, Technical Report APA-TR-2010-1001" October, 2010, at the website of Air Power Australia, http://www.ausairpower.net/APA-SAM-Effectiveness.html.

[35] See, for example, the description of the mobile *Kolchuga* Electronic Support Measure, at http://en.wikipedia.org/wiki/Kolchuga_passive_sensor.

[36] *Scan Eagle* is a small "low-cost, long-endurance autonomous unmanned vehicle" that can be launched from a trailer that can be towed by a small truck or car. See the Boeing website at http://www.boeing.com/defense-space/military/scaneagle/.

[37] I am indebted to Craig Koerner for this insight and analogy.

anti-ship cruise missile carrying wave-piercing catamarans that may carry up to 16 ASCMs.[38] These missile patrol craft all appear to be capable vessels, but the underlying concept can usefully be extended downward. Taiwan should consider the example of Iran's *Peykaap* missile patrol craft. These vessels are approximately 57 feet long, displace some 15 tons, and can achieve speeds of about 52 knots.[39] The U.S. Navy's Office of Naval Intelligence states that the *Peykaap* is equipped with two *Kowsar* ASCM and with torpedoes,[40] but recent statements and videos from Iran have identified the missile as a *NASR-1*,[41] which the Israelis clarified in March 2011 as being an Iranian C-704 ASCM. This missile has a range of 35 km, carries a 128 kg warhead, and is guided by a radar seeker.[42]

These or similar vessels' small size makes them easier and cheaper to build, so Taiwan could produce large numbers of them indigenously. Small size would also permit the wartime use of ports of all sizes, making basing and logistics less vulnerable during combat. Taiwan could easily disperse and hide these lethal craft, making them much less susceptible to a Chinese SRBM surprise attack than is its current fleet. It is one thing to destroy 26 large warships that are on average 140 meters long and 15 meters wide, and that are concentrated in three major bases. It is quite another to destroy many tens of 15-by-5-meter fast missile patrol craft that can be in many dozens of ports, that can be stored in warehouses or hidden in other secure locations including purpose-built caves or hardened "pens," and that can be launched nearly anywhere a crane and a flat-bed truck can reach. Such vessels could be sent on their attack mission individually or in groups with only rudimentary locating data, conduct extended searches with their own radars, develop final targeting data autonomously, deliver lethal ordnance from beyond effective counter-fire range, and escape at high speed to reload.

In wartime, Taiwan does not require and is unlikely to retain for long the enhanced range and endurance of frigates and destroyers. Instead, it needs to extend lethal combat power some tens of kilometers from its ports and beaches to make those waters untenable for intruding Chinese warships, including especially

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[38] These vessels will apparently cost between $70 and $120 Million USD each. See Lo Tien-pin and Jake Chung, "Navy christens stealth missile corvette," Taipei Times, Mar 15, 2014, p. 1.

[39] "Peykaap II (IPS 16 Mod) class," *Jane's Fighting Ships*, 21 February 2013, www.janes.ihs.com.

[40] "Iran's Naval Forces; From Guerilla Warfare to a Modern Naval Strategy," *Office of Naval Intelligence*, Washington DC, Fall 2009, p.6.

[41] See Farhad Pouladi, "Iran Says It's Begun Producing New Missile Boats," *Agence France-Presse*, 23 August, 2010, available at http://www.defensenews.com/article/20100823/DEFSECT03/8230307/Iran-Says-s-Begun-Producing-New-Missile-Boats,"Zolfaghar and Seraj-1 High-Speed Combat Boats," August 24, 2010, available at http://www.uskowioniran.com/2010/08/zolfaghar-and-seraj-1-high-speed-combat.html. A video of the ribbon cutting ceremony of a *Peykaap*, entitled "I.R. Iran's fast attack boats production lines - Seraj and Zolfaqar (part 2)," can be viewed at http://www.youtube.com/watch?v=bVnQp3jx2Gs.

[42] "C-704 Anti-Ship Missiles Found On-Board "Victoria", Israeli Defense Forces Blog, 15 March 2011, http://www.idfblog.com/2011/03/15/c-704-anti-ship-missiles-found-on-board-the-victoria/.

amphibious ships preparing to conduct an invasion.[43] A fleet of *Peykaap*-like fast attack craft (FAC) armed with ASCMs would be able to provide and sustain that sort of at-sea firepower.[44]

To maintain the coercive power of an invasion threat China would have to design and acquire systems that could defeat Taiwan's FAC before they could close to weapons-launch ranges. Likely solutions would probably require large numbers of escorts to protect the amphibious ships, sustained air superiority for supporting surveillance and attack aircraft, deep magazines of effective weapons, new doctrine, intensive crew training, fully professional crews, and robust command and control systems. In effect, China would have to master nearly every aspect of expeditionary joint warfare in order to achieve this objective. This would be difficult, time-consuming and expensive.

The enduring utility of defensive mining

Taiwan can also use mines to counter a blockade and repel an invasion. As the nearly fatal damage the USS Samuel B. Roberts demonstrates, even primitive mines effectively threaten warships.[45] In addition to being lethal, mines are also relatively inexpensive; can be emplaced by a large variety of ships, (and helicopters); are very difficult for opposing forces to detect and neutralize (especially in shallow waters); can be programmed to turn on or off under specified conditions; and can even be selective in their choice of targets.[46] Minesweeping and mine hunting—the unavoidable countermeasures to mines—are laborious, time-consuming and expensive undertakings that require uncontested mastery of the mined waters and airspace above it. China is unlikely to be able to achieve such a dominance of waters critical for the invasion or blockade of Taiwan, and is notably weak in all aspects of naval mine clearance and removal.

Taiwan should vigorously exploit the PLAN's vulnerability to mining; doing so confers significant advantages. Taiwan could develop and manufacture or obtain adequate mines relatively easily, and could store them in dispersed, hardened bunkers impervious to China's missiles. Given strategic or even tactical warning Taiwan could quickly place defensive minefields offshore and along likely invasion beaches, and cover or protect those minefields from Chinese mine-clearance efforts with truck-mounted CDCMs.

Mines could also channel an invading armada into kill zones that could be enforced with munitions delivered by long-range multiple launch rocket systems (which are themselves highly lethal, mobile, difficult to defend against, and relatively affordable). Invading amphibious ships would slow significantly

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[43] FAC like a *Peykaap* are limited by high seas. However, sea or other weather conditions in the Strait of Taiwan that prevented FAC operations would also present formidable challenges to a Chinese invasion fleet.

[44] A 128 kg warhead-tipped cruise missile such as can be carried by a *Peykaap*-sized vessel, would probably cause levels of damage broadly consistent with that caused by the 165 kg warheads of EXOCET and C-802A ASCMs. Advanced seekers such as could be carried by a hypothetical Taiwan-designed and manufactured C-704-inspired ASCM could also choose what portion of the target it strike, thus maximizing the missile's destructive potential.

[45] See, for example, Lee Allen Zatarain, "Tanker War: America's First Conflict with Iran, 1987-88," (Philadelphia, Casemate, 2008), pp. 190-199.

[46] See, for example, Gregory K. Hartmann and Scott C. Truver, "Weapons that Wait: Mine Warfare in the U.S. Navy," (Annapolis, Naval Institute Press, 1979)

as they attempted to negotiate or avoid Taiwan mines, and would thus increase their vulnerability to Taiwan's future CDCMs and ASCM-equipped FAC.

Taiwan could preemptively mine select areas outside its major ports as a means of preventing PLAN ships and submarines from laying or launching mobile mines intended to block these ports. Mobile, long (such as Patriot) and short-range air defenses (which will be discussed shortly) could help prevent Chinese aircraft from mining Taiwan's major ports. Exercises that demonstrated Taipei's ability to accomplish these missions might induce China to invest in a variety of countermeasures, but given the difficulties that other navies have experienced in fielding and maintain proficient mine clearing forces, such an endeavor will probably prove expensive and ultimately ineffective.

Make IADS mobile – learn from the Russians and Serbs

Taiwan should seek to preclude China from establishing air superiority, even after absorbing a bombardment that grounded or destroyed Taiwan's Air Force. To this end, Taiwan should modernize its air defense network,[47] and make it more survivable than it apparently is. It could do so by fielding a large number of modern, mobile short-ranged SAMs and by employing its Patriot missiles in as-mobile-a-manner as possible and devoting them to air instead of missile defense. I discuss these steps below.

Taiwan should obtain or develop and field highly lethal and mobile short range surface-to-air missile systems analogous to the Russian SA-15. This is a fully mobile, autonomous vehicle that can detect, track, and shoot relatively short-range SAMs at aircraft, cruise missiles, and even precision-guided bombs.[48] Mobile systems such as the SA-15, the older SA-6, or the functionally similar US SLAMRAAM are point-defense weapons with ranges typically in the low-tens of kilometers. Offsetting such limited ranges are fast set-up and take-down times, mobility, and their ability to hide. These features make them survivable even in an extended conflict against a formidable adversary, as most Serbian mobile short-ranged SA-6 SAMs were against NATO aircraft in 1999.[49] This results in a disproportionate effect by inducing hostile aircraft to fly above the effective missile altitude—some 6,000 meters for short-range missiles—wherever SAMs are thought to be, thus reducing attacking pilots' ability to positively identify and accurately attack desired targets, especially those that are mobile.[50]

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[47] For a comprehensive description of Taiwan's air defenses, see Sean O'Connor, Taiwan's SAM Network, *IMINT & Analysis*, 5 May, 2009, http://geimint.blogspot.com/2009/05/taiwans-sam-network.html.

[48] For a detailed description of the SA-15, see Carlo Kopp, Kupol 9K330/9K331/9K332 Tor M/M1/M2 Self Propelled Air Defence System / SA-15 Gauntlet, Technical Report APA-TR-2009-0705, July 2009, at Air Power Australia, available at http://www.ausairpower.net/APA-9K331-Tor.html.

[49] Carlo Kopp, "Surface to Air Missile Effectiveness in Past Conflicts."

[50] See, for example, Benjamin S. Lambeth, "NATO'S Air War for Kosovo: A Strategic and Operational Assessment," *RAND*, Santa Monica CA, 2001, pp. xvi, xvii, xxvii, 49, and 90. http://www.rand.org/pubs/monograph_reports/MR1365.html. Forcing the PLAAF to fly above 6,000 meters would put them well above the cloud cover that typically blankets Taiwan, further reducing PLAAF air-to-ground munitions effectiveness.

China would seek to avoid the losses that a network of fully mobile SA-6 or SA-15-like SAM batteries could exact. Countermeasures could include dedicated Suppression of Enemy Air Defenses (SEAD) aircraft that could search for and attempt to destroy elusive mobile SAM batteries (or CDCM trucks). PLA attack aircraft would have to employ suboptimal tactics such as remaining at higher altitudes, (thus reducing the PLA's ability to reliably detect, identify, and attack fleeting targets), and flying around suspected SAM sites which effectively reduces attack aircrafts' endurance. Taiwan could exploit this further by building high-fidelity decoys to deceive China's sensing systems and seduce the PLA's air-delivered PGMs.

Such countermeasures would impose significant costs on China. Each bomb allocated to a decoy extends a conflict, and every homing anti-radiation missile carried to destroy or inhibit mobile-SAM radars represents one less bomb that can destroy other Taiwan defenses or infrastructure. Furthermore, the efficacy of anti-radiation missiles is uncertain. In 1999, NATO fired over 732 HARM missiles, but afterwards determined it had destroyed only "3 of 25 STRAIGHT FLUSH radars associated with [Serbia's] SA-6 SAM systems."[51] This tactical difficulty in destroying mobile SAMs operated in a "shoot-and-scoot" manner significantly extended the conflict. By employing similar air defenses and tactics, Taiwan could do the same against China.

Why Not Submarines?

Some, including many in Taiwan, have long argued for Taiwan's need for conventionally powered submarines. Taiwan's four submarines are nearing or are well past obsolescence, leading to a number of efforts to replace them. In 2001 the United States offered to build and sell to Taiwan 8 submarines in the coming decade for over $12 Billion. For a variety of reasons, this initiative never became viable. Other attempts at obtaining submarines were also unsuccessful, leading Taiwan in early 2014 resolved (or resigned) to build relatively small conventionally-powered submarines domestically, perhaps with outside technical assistance or foreign-supplied sub-components.[52]

I argue that key attributes for effective weapons systems for Taiwan are mobility, lethality, and affordability. Submarines conceptually satisfy the mobility and lethality conditions, but it is a fact that they are especially expensive ships, and are probably not really affordable to Taiwan in absolute terms. They also represent significant opportunity costs since Taiwan could build a significant number of truck-mounted anti-ship cruise missiles or other small, mobile and lethal weapons for the cost of one submarine.

Yet even setting aside affordability issues, there are other reasons to question the utility of Taiwan's submarines in many wartime scenarios. As I discussed in my 2008 article, diesel-powered submarines are

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[51] Lambeth, "NATO'S Air War for Kosovo," pp. 62-63, 109. The SA-6 radars were mobile, the others stationary. Readers should temper these numbers by understanding that one reason for firing a HARM missile is to force defenders to turn off their anti-air radar, thus allowing the attacking aircraft to penetrate into defended airspace. Destruction of the radar is helpful, but not necessary to this tactic.

[52] "Taiwan considers building its own submarines," *Want China Times*, 15 March 2014, http://www.wantchinatimes.com/news-subclass-cnt.aspx?id=20140305000115&cid=1101.

generally ill-suited to anti-submarine warfare (ASW).[53] The primary reasons for this are their slow speeds and the acoustic stealthiness of their potential Chinese prey which would make for a very difficult and protracted undersea battle, with no clear acoustic advantage to either side. Further weakening the case for ASW is a disadvantageous correlation of forces since China has over 60 submarines, and Taiwan would likely have fewer than 10. Taiwan's submariners' ASW skills would have to be far superior to their mainland counterparts' to achieve underwater victory. This seems especially unlikely as China would probably enjoy air superiority over any waters not immediately adjacent to Taiwan, thereby increasing the risk to Taiwan's submarines from Chinese anti-submarine forces (which are admittedly currently weak, but growing). Even if Taiwan could achieve exchange ratios of six-or –more Chinese subs lost for every Taiwan sub sunk,[54] such events would proceed very slowly, probably over the course of weeks or months. Taiwan might not have that much time.

If Taiwan's subs were able to get to sea (before being struck by SRBMs in port) and get in submerged position along the future path of the invasion fleet, then they could destroy some amphibious ships with either torpedoes or cruise missiles. However, there are several issues that would tend to reduce the probability of such an outcome. Foremost among these is the percentage of Taiwan's future submarines that would be mechanically able to get to sea. Observers cannot accurately predict what this number is, but the recent experiences of South Africa which in 2012 had all three of its modern diesel submarines inoperable,[55] and of Australia (which can frequently get fewer than half of its fleet of six Collins-class su submarines to sea,)[56] should temper expectations.[57] Taiwan, like many others, would probably struggle to keep the majority if its submarines and crews ready for combat.

Any Taiwan submarines already or able to get to sea at the war's outbreak would have to transit submerged to a point through which the invasion force would have to pass. Once at such a spot, they could attack any hostile amphibious ships that passed nearby. As a practical matter, however, success in such an endeavor is not a simple or automatic outcome. Targets can be difficult to detect, classify, prioritize for attack, and discern from each other or from nearby innocent vessels. Maneuvering a slow submarine into a preferred position from which to effectively shoot faster surface targets is quite

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[53] Murray, "Revisiting Taiwan's Defense Strategy," pp. 19-20.

[54] Such performance would also imply that Taiwan's submarines would have to benefit from accurate cueing so as to reliably locate and attack Chinese submarines. It is difficult to imagine how that cueing would be provided, given that Taiwan would likely be subjected to continuous missile and aerial bombardment, cyber attack, and intensive electromagnetic jamming of communications circuits throughout the conflict.

[55] Bobby Jordan, "Not one of the R8 billion arms deal submarines is operational," *The Times* (South Africa), 12 August, 2012, http://www.timeslive.co.za/local/2012/08/12/not-one-of-the-r8-billion-arms-deal-submarines-is-operational.

[56] For a condensed version of the complicated story of Australia's Collins-class submarines see "Australia's Submarine Program in the Dock," Defense Industry Daily, 20 April, 2014, http://www.defenseindustrydaily.com/australias-submarine-program-in-the-dock-06127/.

[57] These are admittedly extreme examples of submarine readiness issues, but they graphically illustrate the magnitude of the challenges that even advanced, wealthy countries face in keeping a modern submarine force ready for sea.

challenging, especially in very shallow and acoustically challenging water that characterizes much of the Taiwan Strait. This speed differential also means that the attacking submarine would be unlikely to re-engage any targets missed on a first chance, and would become subject to reactive attacks. One cannot know how such scenarios would turn out, but given that there would be a limited number of submarines operating against potentially large numbers of invading ships, it would be unwise to expect submarines to reliably achieve spectacular successes. Taiwan should consider other alternatives for destroying invading amphibious ships.

A more viable submarine employment option for Taiwan's future submarines would be to attack either directly or via mines PLAN warships as they left or returned to their mainland bases. Yet to do this Taiwan's subs would have to be in position off Chinese ports before or shortly after the conflict started. Since China gets to choose when to start the war, this condition seems unlikely, or requires Taiwan to have a very large submarine fleet, which it can't afford. Regardless, operating close to Chinese ports would place Taiwan submarines in very shallow water (which would be easy for China to defensively mine) and in the heart of China's significant coastal defenses. Confidently operating in such challenging combat conditions would require Taiwan's submariners to have significant peacetime experience in the same operating areas, which would be a risky endeavor. None of these issues are impossible to overcome, but they do suggest that significant risks and operational issues counsel against unreasonably optimistic expectations. Finally, an examination of charts depicting the waters surrounding China's East Sea Fleet naval bases shows that there are many alternative routes to deep water from these ports. It would take a very large number of Taiwan submarines to effectively guard each possible egress route.[58]

A blockaded Taiwan could choose to employ submarines in a counter-value campaign against shipping entering Chinese ports. This is certainly possible and to some extent logical, but it is unclear to what productive end. It is unlikely that the few merchant ships sunk or damaged by a handful of Taiwan submarines would affect war termination conditions. One should also consider that each merchant ship torpedoed would become a magnet for Chinese anti-submarine forces. If these responders had say, a 10% chance of detecting and successfully attacking the submarine committing the initial attack, then each Taiwan submarine could expect to make 6 or 7 attacks before its cumulative probability of being sunk exceeded 50%. This would be a campaign of moderate-to-high tactical risk with uncertain operational or strategic payoff. That insurance rates for ships entering Chinese ports would dramatically rise is true but irrelevant, since insurance for vessels entering the war zone would rise automatically anyway, and shippers would simply charge more to cover those increased expenses for vital cargoes. China can readily absorb those relatively minor costs and losses to shipping.

Another argument sometimes heard in support of modernizing Taiwan's submarine force is that a larger, more capable underwater fleet would force China to devote more resources to anti-submarine warfare. This may be so, but it is also true that China cannot reliably count on the neutrality of all other submarine forces, including that of the United States. Despite this potential threat, China's ASW forces are

[58] This number can be estimated with rudimentary operations analysis. For example, there are three PLAN ESF submarine bases, each with at least two lines of egress, which would require 6 Taiwan submarines to continuously guard. Taiwan would require a fleet of 9 subs for this mission if two of every three Taiwan submarines could be kept forward deployed patrolling these avenues. If other missions were simultaneously required, Taiwan would require additional submarines.

notoriously weak. One has to question whether a handful of Taiwan submarines would compel a dramatic change in PLAN force structure that hasn't yet been caused by the vastly more potent US underwater force.

A last rationale sometimes used to justify Taiwan's acquisition of modern submarines is that they would provide realistic training targets for Taiwan's surface and airborne ASW forces. This is also true, but it is a specious argument since Taiwan's surface forces are unlikely to survive an initial Chinese SRBM/LACM bombardment or long survive against vastly more numerous and better-armed PLAN adversaries, and since Taiwan's ASW aircraft are unlikely to have either secure airbases from which, or secure airspace in which to fly.

In summary, submarines for Taiwan offer some lethality and mobility, but those features come at disproportional cost, and would provide only marginal wartime utility. The United States should encourage, and Taiwan should insist on more affordable, lethal, and survivable alternatives.

Implications

Military weapons systems such as those advocated in this paper are less expensive than are some of the forces Taiwan is trying to buy such as F-16 C/D fighters, (which cost over $50 million each), submarines, (which the United States had offered to Taiwan in 2001 at about $1.5 billion each), and Patriot missile systems (which cost between $3 and $9 million each). It is difficult to accurately estimate the costs of modern short-range mobile SAM systems, but Iran reportedly purchased 29 SA-15 systems from Russia in 2005 for $700 million, or $24 million each.[59] If this is somewhat accurate, then it is theoretically possible to get two short range mobile SAM systems – which do not require a functioning airfield from which to operate or have exorbitant recurring maintenance expenses– for the cost of one F-16. Similarly, it seems reasonable to assume that a *Peykaap*-sized ASCM-equipped FAC should cost less than $15 million, which suggests that Taiwan could build many dozens, perhaps even 100 of these for the cost of one new submarine.

Further, as Taipei continues to shift to an all-volunteer force the portion of its defense budget consumed by personnel costs will inevitably increase, leaving less money available to purchase and maintain expensive planes and ships. This can only result for Taiwan, unless it shifts its defensive strategy, in a smaller force of fewer, more expensive ships and airplanes that will inevitably become increasingly vulnerable to Chinese preemptive attacks by SRBMs, LACMs, and other long-range precision strike weapons. Even if Taiwan's legacy forces survive an initial Chinese bombardment, they are unlikely to long survive a subsequent battle of attrition against what is becoming increasingly a numerically and qualitatively superior PLA.

Consequently Taiwan's current air force and much of its navy have symbolic and operational value in peacetime, but their utility in defeating an invasion or blockade in wartime is at best suspect, and quite possibly approaches nil. They therefore cannot be, and are not an effective deterrent.

Taiwan can avoid this by developing an "anti-air force", and an "anti-navy". Key features of such an evolved, asymmetric military are large numbers of small, lethal, highly mobile weapons systems such as

[59] See Tor "M1 9M330 Air Defense System," at Defense Update, http://defense-update.com/products/t/tor.htm.

truck-mounted coastal defense cruise missiles, short-range vehicle-mounted surface to air missiles, mobile multiple rocket launchers, attack helicopters, sea mines, and small, fast missile patrol craft firing short-ranged cruise missiles, all of which could effectively hide or "live" in hardened bunkers when not in use. Such survivable forces are ideal for a vicious series of short-range engagements that would result in the destruction or greatly-reduced efficacy of China's attack aircraft and surface combatants, including especially Beijing's amphibious assault ships.

A decade ago a number of factors would likely have prevented Taiwan from seriously considering, let alone acquiring the forces recommended here. Taiwan's defense establishment was more inclined to pursue larger, traditional, symmetric weapons systems such as F-16 fighters, Patriot missile defenses, diesel submarines and P-3 maritime patrol aircraft as promoted by US arms manufacturers and associated interest groups including many in the US Congress. But things are changing. For example, Taiwan's 2013 Quadrennial Defense Review (QDR) emphasized the need to develop "innovative and asymmetric" capabilities that can target "the … enemy's critical vulnerabilities..." and the need for "force/firepower for swifter response and greater agile maneuvers".[60] These and similar statements in Taipei's 2013 QDR align well with and show an evolution in thought (which is also apparent, though less pronounced in the 2009 QDR) away from large, iconic, expensive weapons systems towards those that are smaller, mobile, less expensive, and more survivable.

Still, the tendency for Taipei to seek or acquire large, expensive ships remains. Thus, Taipei is said to soon receive two recently decommissioned US *Oliver Hazard Perry*-class frigates.[61] Similarly, the frequent phenomenon of visiting US dignitaries advocating new F-16C/D fighters and submarines for Taiwan probably receives a sympathetic ear of at least some of the local hosts.[62] These somewhat conflicting indicators suggest that Taiwan's security elite are debating whether its legacy forces can provide either a resolute defense or a credible deterrent against a modernizing PLA, and what alternatives – such as those recommended in this paper – might do better.

A similar debate is occurring in the United States. Some US observers continue to advocate for the sale of F-16 C/D fighters and new submarines to Taiwan.[63] Nonetheless, the Obama administration appears reluctant to offer to Taiwan those weapons systems. This hesitancy could reflect a number of potential

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[60] "2013 Quadrennial Defense Review," *Taiwan Ministry of National Defense*, Chapter 2, pp. 31, 41, 13 March 2013, http://qdr.mnd.gov.tw/encontent.html

[61] See, for example, "Taiwan to Buy Two Frigates from US: Defence Minister," *AFP*, 4 November 2012. http://www.google.com/hostednews/afp/article/ALeqM5ha3rD9IQzdxZPiOCn9XfQzNpLmHQ?docId=CNG.2d1696c4c61d5d85d01280b913914548.3b1.

[62] See, for example, "US Congressman Supports New Subs, F-16s for Taiwan," *Want China Times*, 29 January 2013, http://www.wantchinatimes.com/news-subclass-cnt.aspx?id=20130129000119&cid=1101.

[63] See, for example "Import or Die: Taiwan's (Un?)Stalled Force Modernization," *Defense Industry Daily*, 1 May 2013, http://www.defenseindustrydaily.com/taiwans-unstalled-force-modernization-04250/; Michaela Dodge, "Top 10 To-Do List for the National Defense Authorization Act," *Heritage Foundation*, 21 May 21, 2013, http://www.heritage.org/research/reports/2013/05/top-10-to-do-list-for-the-national-defense-authorization-act; and Nick Zahn, "Senator Cornyn: Urgent Action Needed to Bolster Taiwan Defense," 12 February 2013, http://blog.heritage.org/2013/02/12/senator-cornyn-urgent-action-needed-to-bolster-taiwan-defense/.

causes including Chinese opposition to such sales, a sensitivity towards the timing of a given weapons offer, or concerns over the possible compromise to China of sensitive military technology made available to Taiwan. Another and increasingly probable possibility is that there is a growing realization in Washington that traditional, symmetric weapons such as fighter aircraft and large ships have rapidly diminishing utility for Taiwan, and that their sale to Taiwan for a variety of reasons is detrimental to many US interests.

This begs the question of what instead, commensurate with the Taiwan Relations Act and other governing documents and agreements best help Taiwan and protect the United States' interests. This paper answers that question, and offers some specific weapons recommendations as well as more general characteristics of weapons that could comprise an effective, affordable deterrent for Taiwan.

It is not clear what China could do that would effectively counter such a future Taiwan "Anti-Air Force" and an "Anti-Navy." Beijing could develop a true joint expeditionary capability characterized by thoroughly-trained and exercised personnel, perfect communications, deep magazines of expensive weapons and large numbers of the craft that carry them, and a robust supporting logistics system. This would entail major Chinese shifts in military culture, including one away from conscripts toward a truly professional military, and the creation and employment of the doctrine necessary to conduct such intricately coordinated warfare. These steps, which to understate are difficult and expensive, may also ultimately prove ineffective because the possible Chinese measures outlined above do not change the fundamental physical imbalances that underpin this paper's recommended strategy.

Small, mobile, dispersed lethal weapons systems will likely *always* be able to effectively hide in cluttered terrain and deliver lethal ordnance against targets that readily stand out against a background of empty sky or the ocean's surface. China will *always* require air superiority as a precondition to hunting and killing such elusive Taiwan weapons or conducting an amphibious invasion, and Taiwan can *always* prevent or contest for air superiority with mobile SAMs that cost much less than modern aircraft. It is *always* better to be on the "bullet" end of a "bullet-vs.-body" competition. These realities offer Taiwan the basis for an enduring, affordable defensive strategy that can qualitatively make amphibious invasion and blockades less likely to succeed, or require China to develop and maintain vastly larger and more expensive forces than it currently has. An additional benefit is that the reduced likelihood of a successful PRC invasion or blockade reduces the probability of a preparatory precision bombardment as part of a combined campaign.

Thus the ideas in this paper have the potential to render much of China's military modernization moot, at least as far as it applies to Taiwan, and thereby force China to develop and field an entirely new approach to militarily coerce Taiwan. This would take time, possibly decades.[64] Adoption of the ideas in this paper would in the meantime enhance Taipei's bargaining power during any political negotiations with Beijing, thereby increasing the chances of determining peacefully an enduring solution that was acceptable to the people on both sides of the Strait. Additionally, and by no means insignificantly, this strategy would shift

[64] Significant, fundamental changes in modern militaries seem to take 15 to 20 years. For example, the United States required about two decades after the Vietnam War to develop the joint force that displayed its power against Iraq in 1991 and 2003. China required approximately 15-17 years developing and operationalizing its anti-navy in response to the United States' aircraft carrier show of force during the 1995-1996 Taiwan Strait Missile Crises.

the economic burden of providing for Taiwan's immediate defense squarely onto Taiwan, and off the United States. This strategy therefore offers a virtuous circle of effective, affordable, stable, and enduring cross-Strait deterrence, which if achieved would benefit all.

Recommendations for Congress

Encourage Taiwan to develop or acquire, perhaps with US assistance, small, mobile, lethal weapons systems such as ASCM-equipped fast attack craft, truck-mounted coastal defense cruise missile, multiple-launch rocket systems, and short-range air defenses.

Discourage further Taiwan development of offensive weapons systems such as land-attack cruise missiles. It is unlikely that Taipei can build enough such missiles to either deter Beijing or to significantly hamper a Chinese offensive against Taiwan.

Encourage Taiwan to devote no less than 3% of its GDP to its defense.

Craft arms exports to Taiwan so as to provide a more effective conventional deterrent, and to extend the amount of time Taiwan could withstand Chinese military force without immediate outside assistance.

CSBA recommendation	Analogous Weapons	Unit Cost in millions
Penetrating Persistent Airborne Electronic Attack	RQ-4 MQ-4 E2-D B-2	220 [65] 189 [66] 265 [67] 2,100 [68]
Long Range Anti-ship missile	SM-6	5 [69]
Maritime Patrol Aircraft	P-8	275 [70]
Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) System	X-47B	? [71]
New Generation Bomber	B-2	550-2,100 [72]
Harden Guam's Andersen Air Force Base	Large Hardened Aircraft Shelters to hold 12 large or 36 fighter-sized aircraft	700 [73]

Table 1. Estimated Costs for Specific ASB Weapons Systems

[65] "Defense Acquisitions: Assessments of Selected Weapon Programs," General Accounting Office Report GAO-13-294SP, Mar 28, 2013, p. 113, http://www.gao.gov/products/GAO-13-294SP

[66] GAO-13-294SP, p. 103

[67] GAO-13-294SP, p. 57

[68] "B-2 Bomber Cost and Operational Issues," General Accounting Office Report GAO/NSIAD-97-181, August 1997, http://www.gao.gov/archive/1997/ns97181.pdf.

[69] GAO-13-294SP, p. 123

[70] GAO-13-294SP, p. 109

[71] I could not find a reliable UCLASS unit cost estimate. However. a stealthy carrier-launched and recovered aircraft that could conduct surveillance and strike should cost at least as much as non-stealthy $200 million RQ-4 and MQ-4 which don't have to withstand the forces of carrier landings and take-offs.

[72] USAF estimates it can build a new bomber for $500 million, but the B-2 cost over $2.1 billion each.

[73] John Stillion, Fighting Under Missile Attack, Air Force Magazine Vol. 92, No. 8, August 2009, http://www.airforcemag.com/MagazineArchive/Pages/2009/August%202009/0809fighting.aspx