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Key Points

Since Billy Mitchell's sinking of the SMS *Ostfriesland* in 1921, land-based airpower has proved a powerful capability to bring to bear in maritime operations. From intelligence, surveillance, and reconnaissance (ISR) to long-range maritime strike, airpower has proved its effectiveness against maritime targets for nearly a century through several wars and conflicts. The mission, however, is due for a revival after being de-emphasized since the Cold War.

In the Western Pacific in particular, there is an emerging gap in anti-surface warfare capabilities. The People's Liberation Army Navy (PLAN) is deploying large numbers of modern ships, submarines, and aircraft armed with long-range anti-ship cruise missiles (ASCMs), and the ability of the U.S. Navy to address these threats by itself is limited.

To address this gap, the U.S. Air Force should again train and equip its bomber forces for the maritime strike mission as a strong, effective, and cost-efficient deterrent to Chinese naval power. These capable long-range aircraft have large munition capacities, can target maritime vessels on short notice, and can use stealth capabilities to hold PLAN assets at risk—even in defended airspace.

Bombers for Maritime Strike:
An Asymmetric Counter to China's Navy

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Abstract

On July 21, 1921, U.S. Army Brig Gen Billy Mitchell led an air attack that sunk the decommissioned German battleship SMS *Ostfriesland*, shattering the conventional wisdom of the day that warships were invulnerable to air attack. Since that momentous event, aircraft have been sinking ships from the air.

Today, naval vessels are more vulnerable than ever to air attacks. Modern combat aircraft can travel hundreds of miles an hour, and patrol vast expanses of geography in a limited amount of time—in particular, the U.S. Air Force's bomber forces. Their speed, maneuverability, and advanced technologies such as stealth affords superior survivability compared to naval vessels. In an era where netting effects at sea is of increasing importance, such advantages must be considered when developing future strategies, operational concepts, and budget priorities. U.S. Indo-Pacific Command (INDOPACOM) has already carried out recent test exercises proving bombers have significant flexibility, reach, response, and coverage in maritime scenarios facing a near peer military—such as the PLAN.

More capable weapons, like the long-range anti-ship missile (LRASM), have also been developed, increasing bomber lethality in maritime operations. Modern airpower, with cutting-edge sensors, can now conduct all-weather precision engagement of mobile maritime targets at lower levels of risk in hours, versus the days and weeks required for naval vessels. This paper will bring the reader up to date regarding the potential of airpower to dominate maritime operations and calls for a rethinking of the traditional approach taken in constructing contingency plans in the Asia-Pacific region for the 2020s and beyond.

Introduction: Airpower and Maritime Operations

American military interest in land-based airpower for joint maritime operations has historically risen and fallen with the perceived enemy surface threat. During World War II, the U.S. Army Air Forces conducted reconnaissance, anti-submarine warfare, minelaying, and anti-shipping attacks against the German and Japanese navies. For decades after 1945, interest in U.S. Air Force maritime operations languished given a lack of significant enemy naval threats.

The maritime operations mission set should not be thought of as theoretical for land-based airpower. In many ways, airmen are returning to historic roles at which they previously excelled. Army Air Force bombers in World War II played a critical role in anti-submarine warfare, particularly in the Atlantic theater of operations, where long-range, radar-equipped B-24s closed the "mid-Atlantic gap."

In the 1970s, while American naval strength declined, the Soviet Union deployed a large, global fleet equipped with powerful, long-range anti-ship missiles. This action prompted a renewed interest in Air Force maritime operations, resulting in the deployment of B-52 bombers armed with the AGM-84 Harpoon anti-ship missile. By the end of the Cold War, Air Force and U.S. Navy interest in this mission had again declined.

A similar trend is emerging today. The U.S. Navy's fleet size is reduced and a new peer adversary—The People's Republic of China (PRC)—is deploying a large, highly capable naval surface fleet. Once again, there is a growing need for the U.S. Air Force to equip and train bomber forces to counter this growing naval threat. Sensors and data links resident in the current bomber fleet and stealth designed into aircraft like the B-2 (and the forthcoming B-21) are just some of the advantages that demonstrate airpower's potential to ascend to levels of unprecedented effectiveness in maritime operations.

The maritime operations mission set should not be thought of as theoretical for land-based airpower. In many ways, airmen are returning to historic roles at which they previously excelled. Army Air Force bombers in World War II played a critical role in anti-submarine warfare, particularly in the Atlantic theater of operations, where long-range, radar-equipped B-24s closed the "mid-Atlantic gap."[1] In the Pacific theater, land-based bombers sank large numbers of Japanese ships, using highly effective low-level bombing and strafing attacks.[2] The Navy also joined the Army Air Forces in this effort when it procured hundreds of B-24 bombers for maritime reconnaissance and anti-shipping missions. Indeed, during the course of the war, both the United States and Germany used bombers equipped with guided munitions for stand-off, anti-shipping attacks.[3] The B-29 aerial mining campaign of 1945 cut Japan's sea communications and sank or damaged over two million tons of shipping at a cost of only 15 Allied aircraft.[4]

The U.S. Air Force after World War II re-aligned its focus on strategic bombardment and minimized maritime operations. At the same time, the U.S. Navy—facing few enemy surface threats—de-emphasized surface warfare. Instead, naval aviation became the service's *raison d'être* and was primarily focused on interdiction and close air support (CAS) missions during the Korean and Vietnam Wars. After the Vietnam War, the U.S. Navy was cut almost in half; the overall size of the active fleet fell from 1,007 ships to 540 ships between 1969 and 1979. Large-deck aircraft carriers dropped from 22 to 13, and surface combatants dropped from 279 to 178.[5] Meanwhile, the Soviets were in the midst of a naval resurgence centered on powerful surface combatants with large missile payloads. Of particular note, the nuclear-powered *Kirov*-class cruiser carried 20 long-range SS-N-19 Shipwreck anti-ship missiles.[6] When equipped with a nuclear warhead, a single SS-N-19 could destroy

Right: During the Cold War, the Soviet Navy controlled its own fleet of Tu-16 Badger bombers (pictured), which utilized weapons such as the KSR-11 ASCM and other long-range anti-ship missiles.


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Right: A port bow view of the Soviet *Kirov*-class missile cruiser *Frunze* underway. The *Kirov*-class nuclear cruisers were a cornerstone of the Soviet naval buildup of the 1970s, equipped with 20 long-range SS-N-19 Shipwreck anti-ship missiles.


U.S. Navy

Far right: A B-52, equipped with the AGM-84 Harpoon anti-ship missile. B-52s were utilized in the maritime strike mission in the later years of the Cold War, as a response to the Soviet naval buildup.

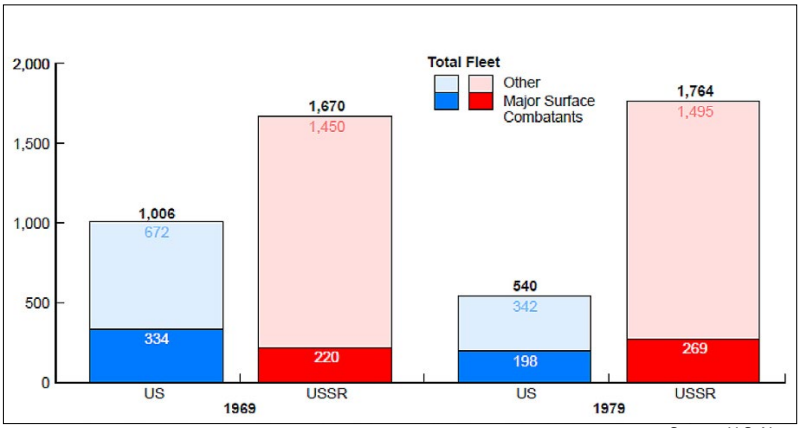

U.S. Air Force

an entire carrier battle group. Furthermore, Soviet naval aviation controlled its own fleet of land-based Tu-95 Bear, Tu-16 Badger, and Tu-22M Backfire bombers armed with similarly deadly, long-range anti-ship missiles.[7]

These developments prompted a resurgence of interest in U.S. Air Force maritime operations. In 1975, the Air Force agreed to train aircrews in ocean surveillance, maritime strike, and aerial minelaying in cooperation with the Navy.[8] This initial cooperation was followed by a 1982 agreement that codified an Air Force role in providing: 1) fleet air defense against Soviet bombers, 2) ocean surveillance, and 3) strike against Soviet surface ships in addition to minelaying and other capabilities.[9] The Air Force evaluated various munitions for use against surface ships, including Harpoon and AGM-65 Maverick missiles, as well as GBU-15 glide bombs. Starting in the mid-1970s, B-52s conducted ocean surveillance missions in the Atlantic and Pacific and practiced communicating and cooperating with Navy assets. By 1983, B-52G bombers equipped with Harpoon missiles were stationed in Maine and on the U.S. territory of Guam, and E-3A AWACS and F-15s were integrated into carrier battle group operations.[10]

During this time, the concept of operations for a B-52 attack on Soviet surface ships envisaged cells of B-52s under the control of either a Navy E-2C, P-3, or an Air Force E-3A. To attack a large Soviet surface force, as many as 10 B-52s carrying 120 Harpoon missiles would descend to low altitude, approach from different directions, and launch a simultaneous salvo to saturate enemy defenses. The bombers would then break away and return to base before the enemy could counterattack. Each B-52 carried more anti-ship missiles than many smaller surface ships and, unlike these vessels, could return to base, reload, and re-attack in a matter of hours (replenishment for a ship is usually measured in days or weeks). Moreover, a B-52 had sufficient range to attack enemy surface groups before they came within range of friendly naval assets.[11]

Figure 1: From 1969 to 1979, the U.S. Navy shrank dramatically while the Soviets transformed and grew their navy from a largely coastal defense force into an ocean-going navy equipped with new long-range anti-ship missiles.



Source: U.S. Navy

The Post-Cold War Drawdown, Naval Power, and Maritime Strike

The size of the U.S. Navy declined dramatically after the Cold War. In the late 1980s, the surface force included four battleships and 208 cruisers, destroyers, and frigates. In addition, the Navy had 14 carriers and 99 attack submarines. In all, the Navy had a total active force of 592 vessels. Today, it has 11 large-deck carriers, 104 surface ships, 51 attack submarines, and a total active battle force of 287 vessels.[12] This 50 percent reduction in surface ship hulls was ostensibly counterbalanced by a near-doubling in missile tubes. In the late 1980s, the surface fleet had almost 5,000 missile tubes, composed of approximately 3,300 vertical launch system (VLS) tubes and 1,600 other tubes such as Harpoon launchers.

Today's Navy surface fleet has almost 9,000 VLS tubes and can deploy eight anti-ship missiles on each littoral combat ship (LCS). However, one ship can only be at a single point at a given time. The need for projecting lethal power in a rapid, decisive fashion is growing given the return to preparing to meet peer threats.

It is important to note the number of missile tubes across the fleet also does not necessarily correspond with offensive striking power, another reason why land-based airpower's maritime strike capacity could be vital in a future war. Today's surface ships are primarily armed with defensive anti-aircraft missiles and ballistic missile interceptors. Offensive missiles are usually only a quarter to a third of the ship's loadout, and offensive missiles are mainly land-attack cruise missiles, not anti-ship or anti-submarine weapons.[13] During a conflict against a capable peer naval opponent, the Navy would likely need to load surface ships with more anti-ship and anti-submarine weapons and fewer land-attack weapons—provided the time and warning to do so. In addition, the requirement for ships to increase their air-defense missile loadout in such a scenario would also increase. Today's Navy surface fleet has almost 9,000 VLS tubes and can deploy eight anti-ship missiles on each littoral combat ship (LCS). However, one ship can only be at a single point at a given time. The need for projecting lethal power in a rapid, decisive fashion is growing given the return to preparing for peer threats.

During the 1980s, the U.S. Navy's anti-ship arsenal consisted of Harpoon and RGM/UGM-109B Tomahawk anti-ship cruise missiles (ASCMs). The former is a sea-skimming subsonic missile, whose range expanded from an initial 60 nautical miles (nm) to later variants that had increased ranges that extended between 150 and 200 nm. The Block II+ variant can receive in-flight targeting updates and strike moving targets.[14] The Tomahawk anti-ship missile (TASM) was a variant of the Tomahawk land attack missile (TLAM). The TASM had a range of almost 300 nm and a 1,000-lb warhead. The TASM was withdrawn in 1994, following the collapse of the Soviet naval threat, and the missiles were converted into TLAMs. In the 2010s, the Navy developed a maritime strike variant of the Block IV TLAM. This missile will be able to strike moving targets out to a range of 869 nm, receive in-flight guidance updates, and discriminate among targets in its terminal phase.[15]

The Navy recently developed the AGM-158C long-range anti-ship missile (LRASM), an anti-ship version of the SM-6 standard missile, and acquired the naval strike missile (NSM). The SM-6, with a range exceeding 250 nm, has a light warhead but enormous kinetic energy due to its Mach 3.5 speed.[16]

Below: An August 2013 B-1B test launch of the AGM-158C long-range anti-ship missile (LRASM).

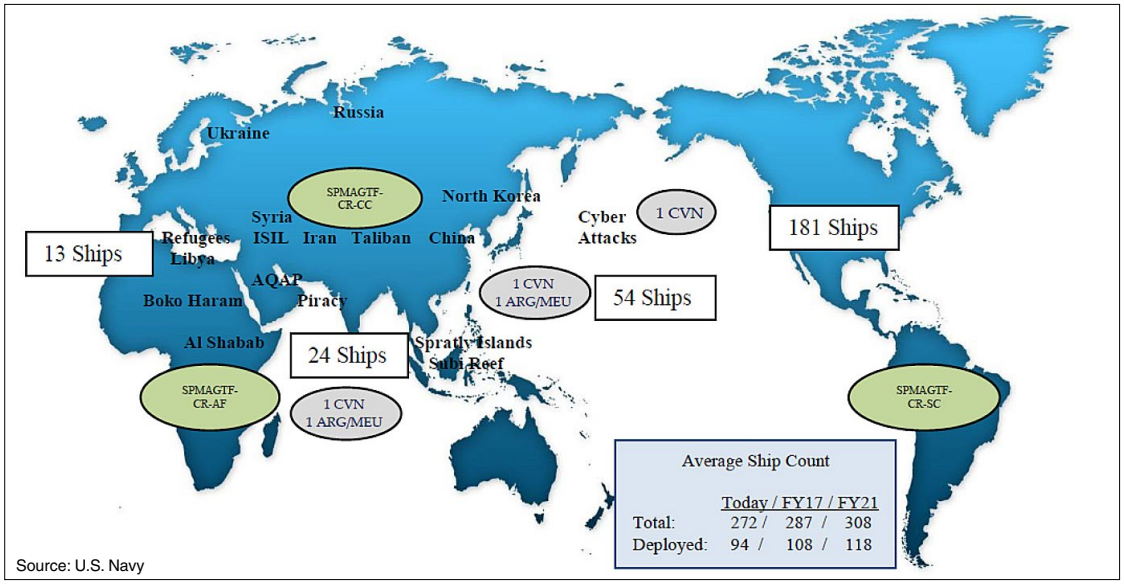
U.S. Air Force

The SM-6 missile successfully sank a target ship in a 2016 test.[17] LRASM has a range of over 200 miles and, like the Tomahawk, has a heavy, 1,000-lb warhead.[18] Surface ships, the F/A-18 Super Hornet, and the B-1B bomber will all employ LRASM. The NSM—a light missile chosen for the LCS—is considered very stealthy, with a range of about 100 nm. NSM launchers could be mounted on the decks of many ships, including logistics and amphibious vessels.[19]

In the event of armed conflict in the Western Pacific, China would likely have a tactical advantage by being able to surge a majority of its navy from nearby ports and attack perhaps 20 percent of the entire U.S. Navy. American naval reinforcements would require over a week to arrive in theater, and only if immediately ready and ordered to sail.

Under the Fiscal 2019 Navy 30-year shipbuilding plan, the number of cruisers and destroyers will remain steady until 2030 at about 100 before decreasing to the low 90s through 2047. The number of smaller surface combatants, such as the LCS, will rise steadily from 40 ships in 2030 to about 60 ships by 2040. The overall surface fleet therefore increases from about 130 vessels to 150 vessels during this period, although most of the increase is in smaller surface combatants. The number of attack submarines decreases from 52 in 2019 to the low 40s by the end of the 2020s, before rising to 60 by the late 2030s. The plan envisages a 342-ship Navy by 2040, falling short of the service's stated goal of a 355-ship fleet.[20]

Regardless of the total naval force aggregate, only a small fraction of the fleet is currently forward deployed in the Western Pacific. Over the past 20 years, the U.S. Navy has typically kept about 100 ships forward deployed in peacetime, with the reminder undergoing maintenance and training in the United States or in transit to or from forward stations.[21] Despite the prominence of the Chinese naval threat, many forward-deployed ships are not in the Western Pacific. For example, in 2015, out of a total of 272 ships, there were typically 54 in the Western Pacific, 24 in the Indian Ocean, and 13 in the Mediterranean Sea, as Figure 2 depicts.[22] The Navy hopes to increase ship presence in the Western Pacific from "about 50" to "about 67" in the 2020s.[23] In the event of armed conflict in the Western Pacific, China would likely have a tactical advantage by being able to surge a majority of its navy from nearby ports and attack perhaps 20 percent of the entire U.S. Navy. American naval reinforcements would require over a week to arrive in theater, and only if immediately ready and ordered to sail.



Source: U.S. Navy

Figure 2: A snapshot of U.S. Navy global engagements in 2015. Despite the prominence of the PLAN threat, only a fraction of the U.S. fleet is forward deployed to the Western Pacific theater of operations.

Above: A Chinese H-6K bomber (variant of the Russian Tu-16) conducting patrols near Taiwan with Su-35 escort fighters. H-6 variants have been equipped with modernized air-launched anti-ship weapons, such as the YJ-81 and YJ-83.

The Challenge of Chinese Naval Power

In a situation somewhat analogous to the Soviet naval surge in the 1970s, Chinese naval power poses a challenge to the U.S. Navy with its increased size and capability. The People's Liberation Army Navy (PLAN) has modernized considerably since 1991, and this modernization has accelerated since the turn of the century. Its surface fleet improvement, however, is only one component of a greatly increased Chinese offensive capability that includes: 1) ground- and air-launched anti-ship cruise missiles, 2) anti-ship ballistic missiles, 3) a modernized submarine fleet, 4) modernized manned aircraft, 5) improved mine warfare capabilities, and 6) large-deck aircraft carriers.

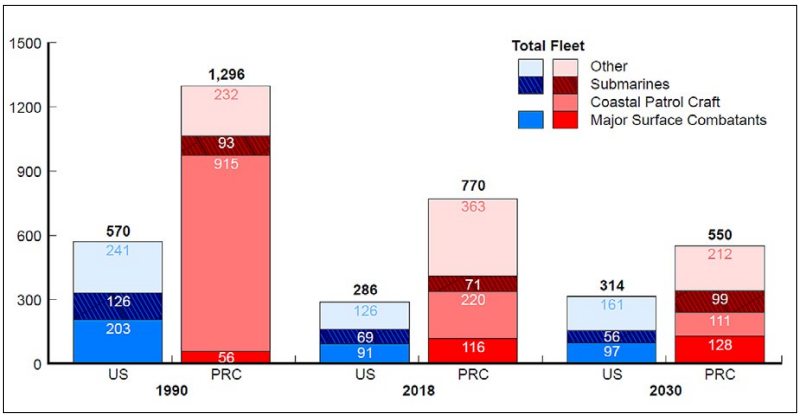
In 2000, the PLAN surface fleet consisted of 21 destroyers, 35 frigates, and 87 missile patrol boats.[24] Of these, only four destroyers, 12 frigates, and 25 missile patrol boats had been built after 1990. The surface fleet carried about 650 ASCMs, mostly of the C-801 type (modeled on the French Exocet anti-shipping missile, with a 23 nm range) but also the SY-1 Silkworm (81 nm range) and YJ-83 (97 nm range). The PLAN had little capability to provide "over-the-horizon" targeting with land-based aircraft or ship-borne helicopters using these weapons. Fleet air defense was also very weak. Only eight ships had air-defense missiles–principally the HQ-7, a Chinese copy of the French Crotale short-range system.

The PLAN attack submarine fleet in 2000 lacked modern vessels. Only five of the 87 submarines were built or acquired in the 1990s; one *Song*-class and four *Kilo*-class boats. The older vessels included five *Han*-class nuclear and 77 diesel-electric boats. Only the *Han* and the *Song* boats could launch ASCMs (the C-801). This force posed only a limited threat to U.S. Navy surface assets.

The PLAN aviation force in 2000 consisted of over 550 land-based, front-line aircraft. Only 73 of these aircraft were modern Su-27 Flankers. The remaining aircraft were primarily Chinese versions of 1950s-era MiG-19, MiG-21, Il-28 and Tu-16 fighters and bombers. These aircraft had a relatively short range, and primitive radars and air-to-air missiles. Fourteen Xian H-6D bombers (the Chinese variant of the Russian Tu-16) were the principal maritime strike force at the time, each carrying two C-801 ASCMs. This force also posed a limited threat to U.S. Navy ships.

The PLAN was modernized in two phases after 2000. Before 2010, China built many new classes of ships but only a few ships per class. After 2010, China focused on larger production runs within a smaller number of ship classes. The total number of hulls in the PLAN has increased only slightly since 2000, but this obscures the important fact that China retired a large number of smaller, older ships and replaced them with newer, larger, more capable ships. In short, the total displacement tonnage of China's fleet has more than doubled since 2000. Since 2014, China has launched naval vessels with a

Figure 3: Since 2000, the U.S. Navy has declined in total size. Meanwhile, the People's Liberation Army Navy (PLAN) has shed large numbers of smaller, obsolete ships and acquired more modern vessels. The PLAN is now on track to exceed the U.S. Navy in surface combatant ships and submarines by 2030.



Source: Congressional Research Service

total tonnage greater than the tonnages of the entire French, German, Indian, Italian, South Korean, or Taiwanese navies—and almost as much as the entire Japanese or British navy.[25] Notable new acquisitions included a domestically developed aircraft carrier, cruisers with 112 VLS missile tubes, air defense destroyers, anti-submarine warfare corvettes, and amphibious ships.

The PLAN surface fleet today includes 27 destroyers, 49 frigates, 40 corvettes, and 112 missile patrol boats. The Chinese surface fleet is 60 percent larger than it was in 2000 and also far more modern. Three-quarters of current PLAN surface ships—16 destroyers, 34 frigates, 40 corvettes, and 83 missile patrol boats—were built after 2000. Some of these ships now have VLS tubes and phased array radars—neither of which they possessed in 2000.

China has developed a ground-based over-the-horizon targeting complex to detect, identify, and target U.S. ships. This facility features land-based radars, land-based manned and unmanned aircraft, and space-based assets.

The Chinese surface fleet's striking power includes over 3,000 missile-launch tubes capable of bringing to bear the C-801, YJ-83, and YJ-62 ASCM, the latter with a range of 220 nm. Fleet air defense has significantly improved as well, with deployment of the HHQ-16 system, which features a maximum range of 22 nm, and the HHQ-9 (similar to the S-300FM and SM-2 systems, with a slant range of 108 nm).

China's anti-ship ballistic missile capability (ASBM) is an entirely new form of anti-surface power, which poses a significant threat. China has deployed the DF-21D ASBM (810 nm range) and the DF-26 (1,600 to 2,200 nm range in anti-ship configuration). These missiles have maneuverable re-entry vehicles and sensors enabling them to strike moving targets. Furthermore, China has developed a ground-based over-the-horizon targeting complex to detect, identify, and target U.S. ships.[26] This facility features land-based radars, land-based manned and unmanned aircraft, and space-based assets.

China's modern submarine force has also greatly expanded since 2000. China has acquired four new nuclear-powered ballistic missile submarines (SSBNs) since 2007. However, the majority of submarine fleet expansion has been in the attack boats category. In 2000, the PLAN had only five new attack boats. Since 1998, it has acquired 45 boats, including two new classes of nuclear-powered boats and one new class of diesel boat. An even-quieter submarine class (Type 095), is expected to enter service in the 2020s. In 2017, China completed a factory capable of building four nuclear-powered submarines per year.[27] New PLAN nuclear boats reportedly have VLS tubes, and Chinese attack submarines can launch the YJ-12 (a supersonic ASCM) and the YJ-18 (a subsonic ASCM with a range of 290 nm).[28] The expansion of the PLAN attack submarine force has major significance for the American surface navy, given that Chinese submarines specialize in anti-surface warfare.[29]

PLAN land-based aviation now consists of 307 modern combat aircraft, including the JH-7 fighter-bomber, Su-30MK2 multirole fighter, and the J-7, J-8, and J-10 multirole aircraft. Twenty-nine H-6G bombers can each carry four YJ-81 or YJ-83 ASCMs for anti-surface strikes. Chinese carriers will also employ the J-15 fighter. Additionally, the PLAN operates over 30 land-based patrol and early warning aircraft, and is developing unmanned air vehicles for maritime reconnaissance and strike.

Collectively, Chinese land-based missiles, aircraft, and submarines could deny American surface vessels access to waters from which these ships could strike Chinese land and naval targets. American military forces would then have to utilize other methods for attacking these targets.

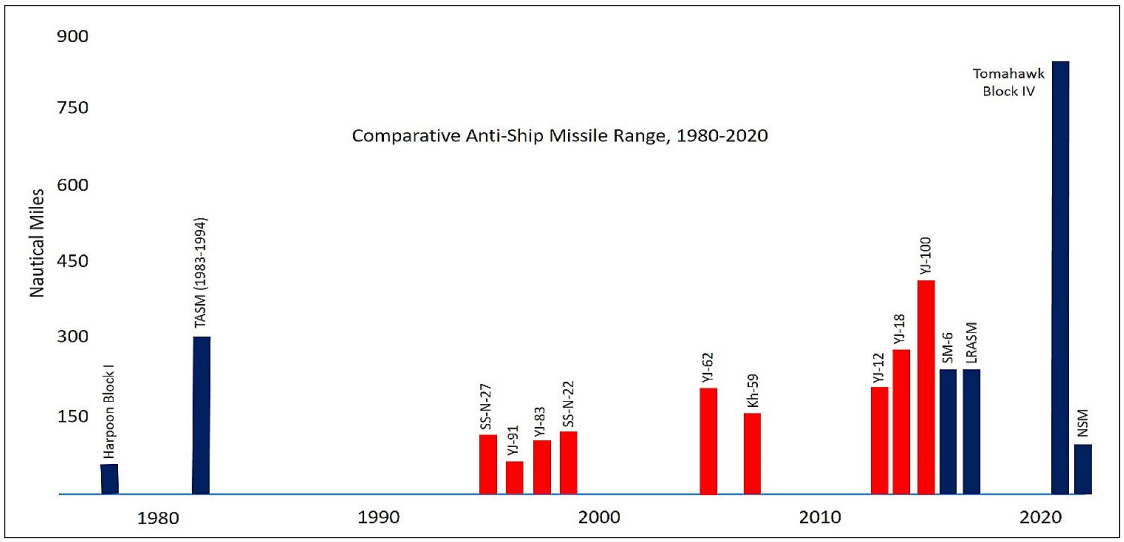
One analysis has projected that by 2030—when the U.S. Navy will have 128 surface combatants and 45 nuclear attack submarines—the PLAN will have 102 destroyers and frigates and 99 attack submarines. This equates to rough surface parity, and clear superiority in the undersea realm.[30] While Chinese submarines may not be as capable as their U.S. equivalents—as there are few nuclear-powered PLAN submarines in the fleet—they will arguably present a clear and present danger to American vessels west of the Mariana Islands.[31]

Overall, China's naval modernization program of the past 20 years has produced a technologically advanced force that is increasingly capable of projecting power far from its coast. While the operational competence of this force is the subject of debate, the PLAN is conducting increasingly complex, sustained, and joint combined arms training.

Overall, China's naval modernization program of the past 20 years has produced a technologically advanced force that is increasingly capable of projecting power far from its coast. While the operational competence of this force is the subject of debate, the PLAN is conducting increasingly complex, sustained, and joint combined arms training.[32] China is "relatively proficient" in anti-surface warfare and has made "notable gains in area air defense."[33] The range and capability of Chinese ASCMs has significantly increased, while China has also refined an operationally concerning ASBM capability. The anti-air capabilities of China's surface fleet have improved, thus pushing China's air defense screen farther out from its coast, making anti-surface warfare more challenging for any potential opponent. This reality poses a significant threat to neighboring countries, U.S. allies, and bases in the region.

Air Force Bombers: An Asymmetric Approach to Countering China's Naval Power

Given this evolving PLAN threat, what are the options for increasing offensive striking power? Building additional surface combatants and submarines is one possibility. The U.S. Navy wants more ships and submarines, although the current 30-year shipbuilding plan does not reach the stated goal of 355 ships.[34] This option is also a very costly way to increase offensive power. For example, *Burke*-class guided missile destroyers (DDGs) cost $1.7 billion each and *Virginia*-class nuclear-powered attack submarines (SSNs), including the payload module, cost $3.4 billion each.[35] The Congressional Budget Office estimated in 2017 that to build, crew, and operate a 355-



Source: Office of Naval Intelligence, CRS

Figure 4: The U.S. Navy neglected anti-ship missile development after the end of the Cold War. Meanwhile, China has acquired numerous anti-ship missiles that outrange the Harpoon, and the U.S. is only now regaining anti-surface reach and striking power with new weapons such as the LRASM, the naval strike missile, and the Block IV Tomahawk cruise missile.

ship fleet would cost 13 percent more than the 308-ship fleet envisioned in the previous Navy plan ($102 billion per year versus $90 billion per year) and would require recruiting 48,000 additional personnel.[36] Moreover, the increase in offensive military power gained via more naval vessels does not always equate to a proportional boost in operationally significant power. *Burke*-class DDGs have 96 VLS tubes but, given the requirements for defensive weapons, probably only 20 to 30 VLS tubes would be loaded with ASCMs. Improved *Virginia*-class submarines can carry 40 Tomahawk-sized weapons in dedicated VLS cells.[37] However, submarines are an exceptionally valued asset that would almost certainly be focused on anti-submarine and land attack missions in the opening days of a conflict.

Bombers provide heavy payload, range, speed and responsiveness. Variants like the B-1B and B-52 are available in relatively large numbers. The B-2 and B-21 are stealthy. These attributes, therefore, make U.S. Air Force bombers extremely well suited for the maritime strike mission.

While carrier-based aircraft are the U.S. Navy's preferred method for maritime strike going back to 1942, modern naval aviation has relatively limited payload and range. The combat radius of an F/A-18E/F fighter, for example, is 400 to 500 nm, depending on the operational assumptions.[38] The combat radius for the Navy's F-35C is 600 nm, with a standard combat payload.[39] While employment of the LRASM improves a naval air wing's reach, taking full advantage of LRASM's 200 nm range would require adequate targeting data. The F/A-18E/F can carry two LRASM per aircraft.[40] The F-35C, however, cannot carry the LRASM internally. Conceivably, the F-35 could carry the LRASM externally, but this would compromise low observability. In a maritime strike package, F-35s would likely escort F/A-18s that would launch a salvo of 32 to 48 LRASMs. If a U.S. Navy carrier had to remain east of Guam due to threats like the DF-26 ASBM, then even a "maximum range" (700 nm) LRASM strike would not penetrate very far into the Philippine Sea. Attempting to employ LRASM against maritime targets close to the Chinese coast would expose the carrier to significant risk. For example, attacking ships in the Strait of Taiwan would put the carrier within 900 nm of mainland China and within range of DF-21 and DF-26 ASBMs, and land-based aircraft. It would also increase the likelihood of enemy submarine attacks. Tactically, carrier-based aircraft would have difficulty approaching the enemy from the multiple, unexpected directions needed to achieve surprise. Moreover, the ability to launch subsequent strikes would depend on the availability of munitions aboard the carrier and its replenishment ships.

Another option is an asymmetric approach: employ U.S. Air Force bombers. This solution has the important advantage of very low cost relative to acquiring additional ships and submarines. Bombers provide heavy payload, range, speed, and responsiveness. Variants like the B-1B and B-52 are available in sizeable numbers. The B-2 and B-21 are stealthy. These attributes, therefore, make U.S. Air Force bombers extremely well suited for the maritime strike mission.

The use of bombers for maritime strike is the most cost-effective option. Indeed, B-52, B-1B, and B-2 bombers are already developed and deployed today. And while the B-21 will be acquired to address other specific mission priorities, it is already programmed into the Air Force budget and will have no financial impact on U.S. Navy priorities. The principal Air Force cost for additional naval-strike capability would be developing and acquiring new ASCMs, training bomber crews in their use, and efforts to ensure adequate Air Force-Navy maritime strike interoperability. If China's operational

naval capability continues to increase relative to the U.S. Navy, employing Air Force bomber maritime capabilities would be a cost-effective, asymmetric response.

Bombers are designed to carry large payloads. The B-52H can carry 8 to 12 Harpoon missiles, and it can also carry 20 JASSM-class munitions.[41,42] The B-1B can carry 24 JASSM-class weapons, and the B-2 can carry 16. Although only the B-1B has launched an LRASM, this missile is based on the JASSM and has the same length and weight. Thus, the B-52 and B-2 could likely also carry LRASM. Air Force aircraft have never launched the Tomahawk cruise missile. However, the Tomahawk is slightly smaller and lighter than the AGM-86C/D conventional ALCM, of which the B-52 can carry 20 at a time.[43] The Air Force should investigate the possible integration of an anti-ship Tomahawk variant onto B-1B and B-52 bombers to enhance the bomber fleet's maritime capabilities for little additional investment (the Navy will deploy a Tomahawk anti-ship type in the 2020s). A bomber with 20 Tomahawks (each with a range of 869 nm) could threaten vessels operating in the Chinese littoral from well outside the range of ground-based air defenses.[44] A single bomber equipped with LRASMs could launch a salvo equivalent to that of a destroyer or submarine. Two bombers could launch a salvo as large as that of an entire carrier air wing. This is a useful capability to consider when trying to overwhelm capable, modern enemy defenses.

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American bombers, with aerial refueling, have unlimited range. The B-52, B-1B, and B-2 have flown numerous missions from bases in the United States to strike targets in Asia before safely returning to the United States. Bomber combat radius—the maximum distance they can travel to the target and return without refueling—is on the order of 2,500 to 3,500 nm, depending on payload. This enables bombers to: 1) strike from distant bases that are safe from enemy attack, 2) approach from unpredictable directions, and 3) attack from multiple azimuths simultaneously, thereby surprising and overwhelming the defender.

The high speed of bombers, especially relative to surface ships, enables them to strike targets anywhere on Earth quickly. In principle, B-1B bombers could strike maritime targets in the Western Pacific within 13 hours of taking off from continental U.S. territory. A bomber in Hawaii could strike the Western Pacific in under nine hours, with a single refueling each way. A bomber in Australia could reach the Western Pacific in under six hours with no refueling. Bombers based in Hawaii could also recover or refuel at other locations, such as bases in Australia or on the island of Diego Garcia in the

Figure 5: Stealth bombers have great potential utility for maritime strike operations. B-2 bombers based at JB Hickam-Pearl Harbor, HI, for example, could conduct anti-ship strikes in the Strait of Taiwan with only a single aerial refueling each way.

Source: U.S. Air Force, Jane's, CRS

Indian Ocean, after striking in the Western Pacific. The capability to strike rapidly, and at short notice, could deter Chinese maritime aggression by threatening to destroy highly valuable PLAN naval assets and thereby undermine Chinese strategic planning.

Speed provides rapid restrike capability. Bombers could return to base, reload, and launch additional strikes in a matter of hours. In contrast, submarines or surface ships that expend their munitions would take over a week to return to Hawaii from a Pacific theater operation against the PLAN. After time required to reload VLS tubes, it would require another week to return to combat in the same area. Even if the Navy found a way to reload in forward anchorages, or underway instead of returning to port, the number of "salvos per week" land-based bombers could launch would significantly exceed the numbers that surface ships and submarines could launch.[45]

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How bombers would be vectored to targets and cued for over-the-horizon attacks is an important operational question to address. All shooters must distinguish enemy warships from neutral or friendly ships. The mobility of maritime targets complicates this problem. In the 1980s, the Air Force and Navy practiced strike cueing by using the E-2C, P-3, and E-3A AWACS to cue B-52 bombers for maritime operations.[46] Pacific Air Forces' (PACAF) "Resultant Fury" test exercise in November 2004 demonstrated that the E-8C JSTARS aircraft could find and track maritime targets, then pass information to a B-52 that could strike and sink targeted ships. The Navy's new P-8 and MQ-4C patrol aircraft could also detect and track maritime targets.[47] Networked collaborative capability has steadily increased with continued experimentation and exercising since then, and so too has sensor technology. The maritime strike mission epitomizes what it means to engage via the "combat cloud" construct, linking together various sensor and shooter aircraft and platforms.

One concern about these aircraft, however, is their survivability. Ship-borne air-defense missile systems are increasing their range and effectiveness over time, and enemy ships may be operating under the umbrella protection of even more capable land-based air defenses. Also concerning is the prospect of a mature Chinese carrier air wing that can project an integrated air-defense bubble with a 500-700 nm radius. In the late 2020s, China may have as many as four carriers in the 100,000-ton class, equipped with J-15 fighters, J-31 stealth fighters, and KJ-600 early warning aircraft.[48] American patrol and tanker aircraft would have to manage this threat in a combat operation, until neutralized or rendered ineffective.

A compelling operational solution for finding and tracking maritime targets in a high-threat environment is to employ stealth aircraft like the B-2 and the forthcoming B-21 bomber. Stealth bombers have the range and endurance to find enemy surface ships within close proximity of these targets, and are then capable of transmitting precise sensor data to both stealthy and non-stealthy shooters at various ranges, thereby enabling all shooters to take full advantage of the ranges of their respective weapons. Stealth bombers could launch attacks on maritime targets in close proximity with large numbers of smaller weapons while B-1Bs could strike at a distance using LRASM missiles—severely complicating the defensive problem for Chinese surface ships, or other adversary surface ships. Finally, stealth bombers could employ extremely cost-efficient, direct-attack weapons to finish off any crippled enemy ships after an ASCM strike.

Conclusion: A Strong, Effective, and Cost-Efficient Counter to PLAN Power

In summary, there is an emerging gap in anti-surface warfare capability, particularly in the Western Pacific area of operations. China is deploying an increasing number of highly capable ships, submarines, and aircraft armed with short and long-range ASCMs. The ability of the U.S. Navy to counter these threats with surface ships, submarines, and carrier-based aircraft is limited. To address this gap, the U.S. Air Force should train and equip its bombers for the maritime strike mission, as it once did just a few decades ago during the Cold War. Bombers can launch large salvos of ASCMs at short notice and from multiple directions. Stealth bombers can threaten and destroy Chinese naval assets if needed, even within the umbrella of China's land-based air defenses. These stealth bombers can also cue non-stealthy shooters for over-the-horizon attacks. In total, the capability of U.S. Air Force bombers to strike targets close to the Chinese coast: 1) represents a strong, effective, and cost-efficient deterrent to Chinese aggression; 2) bolsters American naval forces in their continued efforts to counter increased Chinese naval power; and 3) enhances the overall American national security response to Chinese revisionist aspirations around the globe, especially across the Pacific theater of operations. ✪

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