THE ARSENAL OF DEMOCRACY

TECHNOLOGY, INDUSTRY, AND DETERRENCE IN AN AGE OF HARD CHOICES

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THE SURFACE FLEET

The US surface fleet, which has long been the backbone of American naval power, now faces profound uncertainty. The fleet's offensive combat power is concentrated in carrier air wings (CVWs), which consist of aircraft carriers protected by a screen of destroyers, cruisers, and sometimes submarines. For decades, this configuration has allowed the US Navy to maintain global sea control and project power ashore. However, the emerging scouting and strike trends discussed in previous chapters have raised fundamental questions about the long-term viability of large surface combatants, including aircraft carriers. They have also thrown into doubt the Navy's current surface force structure and long-term procurement strategy.[1]

As China's reconnaissance-strike complex (RSC) improves, high-value US surface ships—especially carriers—must either operate farther away from contested zones, field longer-range aircraft and missiles, or use new techniques to mitigate their vulnerabilities. This trend may continue if China continues to refine its targeting capabilities and expand its arsenal of anti-ship ballistic missiles (ASBMs) and anti-ship cruise missiles (ASCMs).[2] In time, unmanned surface vehicles (USVs), unmanned aerial vehicles (UAVs), and long-range loitering munitions may pose additional threats to US surface ships.[3] If the existing fleet cannot be effectively defended against them—and supported during the adaptation process by the logistics system described in chapter 4—its utility in critical combat scenarios may diminish over time. The US Navy may have to rethink the structure and deployment of its entire surface fleet, potentially weakening deterrence if no stopgap solution is available.

As we have seen, the US Navy is responding to this challenge through Distributed Maritime Operations (DMO).[4] The surface fleet is developing new techniques to disrupt adversary scouting, spreading out the fleet geographically, and deploying more long-range anti-ship missiles on surface combatants, which reduces the centrality of the CVW. The United States is also developing long-range missiles, unmanned systems, refuelers, and other capabilities that will enable surface ships and carrier-based aviation to engage in a fight across greater distances.[5]

Still, as policymakers contemplate the longer-term structure of the surface fleet, it is reasonable to ask: Given the long-term trends in scouting technologies and in the range and accuracy of adversary missile systems, what technological changes, weapons systems, and employment models might need to be developed, through and beyond DMO, to preserve the fleet's survivability and combat effectiveness? Moreover, could we reach a point in the medium term where large surface ships become largely irrelevant in combat scenarios over Taiwan, regardless of how they adapt?

The design of the future force depends largely on how US naval planners answer these high-level diagnostic questions. For most of modern history, fleet size and tonnage have been key metrics for assessing naval power. If emerging technology makes these metrics less relevant, how large a fleet does the United States need to preserve deterrence, and how should the composition of the fleet evolve over time? Would a fleet of smaller, numerous warships or unmanned systems be more viable and cost-effective? If so, how long would this transition take, and what can be done in the interim to preserve US combat power? The answers to these questions are highly consequential because building surface ships is very expensive and time consuming; the US maritime industrial base has constrained capacity; and ships, once built, usually spend decades in service.

This chapter first looks to some historical comparisons for inspiration and then discusses the key debates that the US Navy faces today. The advent of the torpedo in the late nineteenth century, the dreadnought revolution in the 1900s and 1910s, and the subsequent transition from gunships to carriers in the 1930s and 1940s provide some inspiration for thinking through current choices. Military planners today cannot know if trends in scouting and long-range strike will ultimately render aircraft carriers and other large surface ships obsolete or whether emerging defensive technologies and longer-range ship and air-launched missiles will allow them to stay relevant. In the face of this fundamental uncertainty, the best approach is a hedging strategy in fleet design and procurement. The Navy should maintain a diverse fleet that can adapt regardless of whether offensive or defensive technologies become dominant beyond the next decade, balancing investments in traditional large surface combatants with new distributed concepts, unmanned systems, and advanced defensive technologies. Over time, surface ships that cannot readily be adapted should be quickly divested. More important, beyond specific *capabilities*, the US defense industrial base should maintain the *capacity* to evolve the surface fleet quickly as the answers to the questions in this chapter become clearer.

Historical Inspiration

Our current moment is not the first time that surface warships have faced potentially existential threats from emerging strike technologies. Before the development of the torpedo, naval power was synonymous with large, heavily armed warships—battleships, armored cruisers, and other big-gun vessels.[6] These ships were expensive to build, required large crews, and represented the pinnacle of a nation's military and industrial power.[7] Navies measured their strength by the number of capital ships they could field. Controlling the seas was largely about deploying these massive fleets to engage in decisive battles. The torpedo, invented in the 1860s, called this regime into question.[8] Torpedoes were relatively cheap to produce, and small, fast vessels could use them to sink larger and slower battleships if they could get within range. Acknowledging that the British Royal Navy had larger and superior battleships, France was particularly quick to embrace the torpedo.[9] The *Jeune École* (Young School) of naval thought imagined that swarms of torpedo boats and other small, cheap vessels could eventually neutralize the advantage of Britain's much larger fleet.[10]

The torpedo did not render the battleship obsolete, however. Instead, navies adapted by developing new countermeasures and specialized ships to defend against the torpedo threat. The British developed "torpedo boat destroyers"—small, fast ships designed to hunt down and destroy torpedo boats before they could threaten the larger capital ships.[11] These ships eventually evolved into "destroyers," a type of multipurpose surface combatant still in the fleet today. The Royal Navy also developed anti-torpedo defenses such as torpedo nets, which were deployed around battleships at anchor to protect them from attack. In a theme that recurs across in this book, technological disruption did not immediately render existing platforms obsolete. Instead, the incumbent force adapted by integrating disruptive new technology into its force structure and developing new operational concepts. Indeed, the creation of a new ship type in response to the torpedo threat ultimately *enhanced* the power of traditional fleets, and battleships remained dominant for several more decades.

Another illuminating historical case is the dreadnought revolution of the early twentieth century, discussed in chapter 1.[12] The launch of HMS *Dreadnought* in 1906, combining all-big-gun armament with steam turbine propulsion, posed an existential threat to existing battleships. Naval powers adapted by embracing the new technology and integrating it into existing force structures. The revolution in battleship design sparked intense naval competition but also drove innovation in fire control, armor protection, and fleet tactics. Like the torpedo case, this showed how technological disruption could reinforce rather than replace existing platforms while spurring broader naval transformation.

A third relevant historical case is the transition from battleships to aircraft carriers after World War I.[13] The battleship was the undisputed capital ship of the early twentieth century, designed to engage other battleships in decisive gun duels. But the rise of naval and ground-based aviation during and after World War I called into question the battleship's supremacy.[14] Aircraft carriers, capable of projecting airpower over vast distances, began to displace battleships as the primary instruments of naval power.[15] The question facing navies in the interwar period was not *whether* aviation would play a role in naval warfare but *what* that role would be. Many navies initially saw aircraft carriers as support vessels for battleships, anticipating that they would provide reconnaissance and spotting for the battleship's big guns. Moreover, a number of theorists assumed that carrier fleets might cancel each other out during waves of airstrikes and that the battleship line would then sweep in and destroy what remained of the enemy.[16] It was only through combat experience in the Pacific theater that the true potential of the aircraft carrier was realized.

By 1944, the demonstrated ability of carrier-based aircraft to strike enemy ships at ranges of 370–460 kilometers had fundamentally changed naval warfare, though the pace and implications of this shift were debated by naval planners throughout the war. Although aircraft carriers had become the primary offensive platform for the US Navy in the Pacific by 1943, the transition in naval doctrine and force structure continued well into the postwar period. Naval airpower evolved through extensive operational experimentation and the development of specialized aircraft like the Dauntless dive bomber and Avenger torpedo bomber. Meanwhile, battleships and cruisers remained crucial for night surface actions, shore bombardment, and carrier task force air defense throughout the war, particularly in the Solomon Islands campaigns of 1942–43.[17]

These historical cases suggest three observations relevant to the current surface fleet debate. First, technological transitions rarely render existing ships immediately obsolete. Rather, old and new technologies coexist and evolve together for extended periods. This was true for battleships adapting to torpedoes and later for the transition from battleships to aircraft carriers. In both cases, the older platforms remained relevant while new operational concepts and countermeasures were developed. Second, successful adaptation to new military technologies requires extensive experimentation at scale. Both the Royal Navy's response to the torpedo threat and the US Navy's development of carrier warfare demonstrate that military organizations must invest significantly in both offensive and defensive capabilities to master new technologies. This experimentation must include both technical development and operational concept testing. Third, sometimes the best way to integrate new technologies is to modify existing platforms rather than replace them wholesale. The evolution of destroyers from torpedo boat destroyers and the development of aircraft carriers from converted battleship hulls show how existing platforms can be adapted to incorporate new capabilities.

The Evolving Threat to Surface Ships

As earlier chapters have described, the US Navy's ability to project power through its surface fleet already faces severe challenges from adversaries armed with long-range precision missiles and increasingly sophisticated unmanned systems. China's anti-ship ballistic missiles (ASBMs) are designed to target US aircraft carriers and other large warships at ranges exceeding 2,150 kilometers.[18] These missiles, combined with China's growing surveillance and targeting capabilities, have the potential to deny the US Navy access to critical areas in the Western Pacific, including the Philippine Sea and the Taiwan Strait.[19] China and other adversaries are also fielding large numbers of anti-ship cruise missiles (ASCMs).[20]

The rise of unmanned systems further complicates the threat picture for US manned surface ships. In recent years, unmanned surface vehicles (USVs)[21] and loitering munitions[22] (aerial drones with explosive warheads[23]) have proliferated and grown increasingly sophisticated. Ukraine's use of USVs in the Black Sea, for example, has demonstrated how relatively cheap, unmanned platforms can threaten or even damage larger, better-armed ships.[24] The combination of long-range missiles and unmanned systems promises a fundamental shift in naval warfare. Adversaries are increasingly capable of launching large-scale, coordinated attacks on surface ships from long distances and at an increasingly favorable cost relative to the cost of current air and missile defenses. Depending on the risk tolerance of US commanders and the cost and availability of defensive systems, US surface ships may choose to operate at stand-off ranges where it is harder to contribute to a fight.

The Navy envisions a more dispersed and networked fleet, with smaller surface combatants and unmanned systems spread out across a wide area. It also emphasizes new, highly classified techniques to complicate adversaries' targeting efforts. By shifting some of the Navy's offensive strike capabilities from aircraft carriers to surface combatants like destroyers, cruisers, and even smaller ships armed with long-range missiles, the Navy hopes to expand its total strike capacity even as carriers operate from farther away. This concept addresses a key vulnerability: Under the current fleet architecture, losing a carrier means losing a significant portion of the fleet's combat power. Under DMO, the fleet's armed surface ships could at least in theory continue to fight even without the carrier.

Crucially, achieving DMO requires that surface combatants carry adequate stockpiles of long-range anti-ship missiles. Given the importance of stealth, US surface combatants would ideally be capable of reloading Vertical Launching System (VLS) cells at sea, rather than having to return to one of a small number of ports that China could target.[25] In October 2024, the Navy conducted its first successful VLS reload at sea, using prototype technology from the 1990s that was canceled due to cost.[26] The Military Sealift Command's dry cargo ships can quite easily accommodate reloading equipment. Still, it will probably be several years before the Navy can conduct large-scale VLS reloading at sea.

Meanwhile, the Navy is investing heavily in integrated air and missile defense (IAMD) systems for the surface fleet. These systems are designed to provide multilayered defenses against threats from high-end hypersonic glide vehicles (HGVs) and hypersonic cruise missiles (HCMs) to traditional cruise missiles and loitering munitions. The Navy's current IAMD system, centered around the Aegis Combat System, is a critical component of its defense against missile threats.[27] Aegis-equipped destroyers and cruisers provide the backbone of the Navy's missile defense capability, using advanced radar and missile systems to detect, track, and engage incoming threats.

However, the Navy's current IAMD systems have limitations. Each Aegis-equipped ship operates independently, with limited ability to share targeting data across the fleet. This isolation creates vulnerabilities when confronting large-scale, coordinated missile attacks. To address this weakness, the Navy is working to develop a more integrated, networked missile defense architecture that can share data across multiple platforms.[28] This networked approach allows the fleet to identify, track, and intercept incoming weapons across a much greater area by integrating sensors from multiple ships. The spacing between ships remains flexible and can be adjusted based on specific combat scenarios, but ships can carry only finite numbers of interceptors. As the cost of unmanned systems declines, relying on traditional interceptors may become not only uneconomical but operationally nonviable.

To supplement traditional missile defenses, the Navy is exploring new counters—but these technologies are still maturing and present their own challenges. Directed energy weapons (DEWs), including lasers, particle beams, and high-powered microwaves, could potentially offer cost-effective defense against large numbers of drones and missiles. Their "ammunition" capacity is limited only by power generation.[29] Railguns, which use electromagnetic energy to launch projectiles at hypersonic speeds, could also provide a cheaper and more sustainable alternative to traditional missile interceptors. However, both technologies are still immature and are hard to integrate fully. DEWs are less effective in rain and fog.[30] They require more energy than some classes of warships can generate, and there are limits to how much existing ships' power engineering systems can be upgraded. Railguns have durability problems. Barrels can be degraded after a limited number of shots, and they, too, require extraordinary amounts of power.[31] Electronic warfare and other deception efforts can potentially confuse incoming missiles and make them hit false targets. Missile-tracking mechanisms and deception techniques are engaged in an ongoing cat-and-mouse competition. Larger-caliber autocannons mounted on ships can intercept incoming missiles, but any time a missile gets so close to a warship, the chances of a successful strike are considerable. Even if the missile is intercepted, debris can cause serious damage.

In short, emerging defensive technologies are likely to make at least some US surface ships more survivable, but many systems either remain immature or face significant operational hurdles. For at least the next five to ten years, surface ships will likely be increasingly vulnerable to large-scale coordinated attacks, particularly as adversaries continue to refine and proliferate low-cost unmanned systems and advanced missiles. This reality is driving US naval planners to adapt the composition and operational practices of the fleet, with an emphasis on distributed maritime operations and the development of more resilient defense architectures. It makes investments in scouting, counter-scouting, and long-range munitions production all the more important. Congress, the Office of the Secretary of Defense (OSD), and the Joint Staff have not provided sufficient leadership to support the Navy during this period of transition. As one analyst put it in 2017, the DOD gets "no points for internal excellence."[32] Competence matters only if it is translated into a clear procurement program that matches operational concepts.

USVs and UUVs

Unmanned systems will almost certainly play an increasingly important role in the future US fleet, augmenting the capabilities of manned ships and conducting operations independently. Unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs) will also be vital to making DMO possible.[33] USVs offer two key advantages: They are generally cheaper to operate than manned ships, since they can have few to no crew who require food, water, and salaries, and they can be deployed in high-threat environments without jeopardizing human lives. Theoretically, technologically mature USVs and UUVs can perform a range of missions, including reconnaissance, surveillance, mine countermeasures, and even land-attack and anti-ship strike operations, while remaining at sea for as long as their power supply is sustained.[34]

The Navy plans to acquire several different classes of USVs and UUVs, in addition to aerial drones (UAS).[35] In 2018, the DOD's Strategic Capabilities Office launched the Ghost Fleet Overlord program for large USVs; these are roughly 60 meters long and displace 1,000–2,000 tons, and they field anti-ship and anti-land missiles. These ships are now being tested.[36] Medium USVs (under 60 meters in length) are primarily intended to support intelligence, surveillance, reconnaissance, and targeting missions.[37] The Navy is also testing the Global Autonomous Reconnaissance Craft (GARC), a small USV that displaces just 1,630 kilograms but can move as fast as 35 knots and has a range of 1,300 kilometers.[38] The Navy is currently investing roughly $330 million per year in developing these capabilities.[39]

UUVs fall into two categories: those that can be deployed from manned submarines and larger ones that must be launched from a pier or larger surface ship. These UUVs can carry mines, torpedoes, and various jamming systems and other electronic disruptors.[40] They are more cost-effective than manned ships and are ideal for long-duration missions that would be too taxing for a human crew.[41] The first five large UUVs, known as Orcas, were funded in FY 2019 and purchased from Boeing for approximately $275 million, though the program is now over budget and behind schedule.[42] Large UUVs, however, do face some clear constraints, including access to high-performance batteries.[43] Overall, diversifying the fleet to include USVs and UUVs of various sizes and functions will be key to realizing the DMO vision.

Maintaining reliable communication networks in contested environments is another key challenge for DMO. Without secure, resilient communications, dispersed forces could struggle to operate cohesively, fail to deliver concentrated effects needed for mission success, and become individually more vulnerable. USVs are useful only if their command-and-control systems remain robust under these contested conditions. Although the Defense Department has begun to invest in advanced data links (particularly for the F-35 fighter jet) and improved satellite communications, significant hurdles remain in ensuring seamless communication among ships, aircraft, and unmanned systems.[44] China and Russia have heavily invested in electronic warfare (EW), and the shift to DMO might make China more willing to turn to antisatellite warfare in a crisis.

The shift to DMO also increases the demand on the US logistics enterprise, as discussed in chapter 4. A dispersed fleet model is more complex to supply because fuel, munitions, and other resources must be delivered in a timely fashion to a larger number of platforms distributed over a much larger geographic area. The further resupply craft must travel, the more vulnerable they are to being struck themselves. Eventually, DMO will require a network of autonomous resupply systems, pre-positioned stockpiles, and resilient logistics hubs. Until this logistics network is fully built, the Navy's ability to implement DMO successfully may be rate-limited by the availability of MSC supply ships and other variables. Moreover, China might calculate that if the US logistics network faces attrition, the Navy cannot continue DMO through a protracted conflict. During the transition, it is therefore essential for the United States to deepen coordination with allies and partners to pre-position supplies across the Second Island Chain. Unless all relevant supplies are pre-positioned in quantity, the logistical challenges with DMO may become unmanageable.

To summarize, USVs and UUVs of various sizes will be central to the future fleet, but the existing manned fleet will carry most of the load through the early 2030s and likely well beyond. A key question, then, is how large the US manned surface fleet must be—in terms of tonnage and ship count—to preserve deterrence. Answering this question effectively requires thinking beyond DMO.

Sizing the Fleet

The size and composition of the US Navy's surface fleet have long been subjects of debate among military planners, policymakers, and defense analysts.[45] This section does not take a position on the optimal size of the fleet at any particular future date. Instead, it frames the debate by examining the trade-offs among fleet size, fleet tonnage, and fleet composition in the context of industrial and budgetary constraints. Notably, this section limits its discussion to the surface fleet's role in large-scale combat against a peer adversary like China. There are good reasons to maintain a robust surface fleet for other contingencies in the Indo-Pacific and other regions. Even if specific ships grow less useful in specific high-intensity combat scenarios, they will probably add value elsewhere.

As of 2024, the US Navy operates a fleet of approximately 296 battle force ships, including aircraft carriers, destroyers, cruisers, submarines, amphibious ships, and smaller surface combatants.[46] The Navy's goal, established in its thirty-year shipbuilding plan, is to increase the fleet size to 355 manned ships and more than 130 unmanned surface and underwater vehicles by the mid-2030s.[47] However, the path to reaching this goal has been fraught with challenges, including rising costs, shipbuilding delays, and a creaking defense industrial base (DIB).

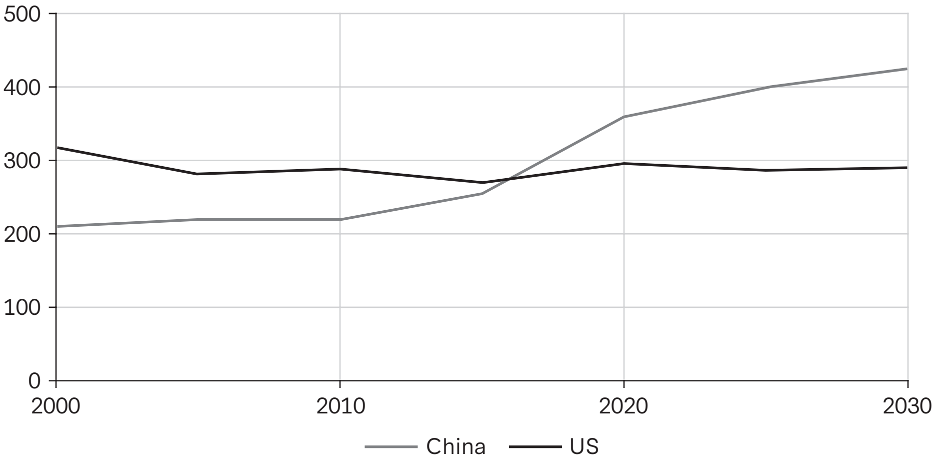

Figure 5.1 PLAN and USN fleet size with Office of Naval Intelligence projections

Source: Ronald O'Rourke, *China Naval Modernization: Implications for US Navy Capabilities—Background and Issues for Congress* (Congressional Research Service, August 16, 2024).

The rapid expansion in the People's Liberation Army Navy (PLAN) surface fleet is the most obvious argument for expanding the US fleet (see fig. 5.1).[48] The PLAN's growing capabilities include advanced large cruisers, destroyers, frigates, submarines, and amphibious ships, as well as a burgeoning carrier force.[49] China is building more of every ship type, on faster timescales, and has multiple times the shipbuilding and maintenance capacity than the United States.[50] The PLAN's quantitative advantage in fleet size—it is still smaller in terms of tonnage—is amplified by the fact that it is geographically concentrated in the Western Pacific. As long as the United States has strategic commitments in Europe, the Middle East, and the Americas, as well as in the Indo-Pacific, the US Navy must disperse its forces accordingly. At any given time, part of the US fleet will be close to retirement and a substantial fraction of it will be undergoing maintenance or work-ups thousands of kilometers away from the Indo-Pacific. Moreover, only ships that are capable of operating in a high-threat environment characterized by long-range precision strikes, sophisticated surveillance systems, and anti-access/area denial (A2/AD) challenges are useful for the purpose of deterring China. Although simply counting ships is a poor measure of the overall balance, China's naval buildup strongly suggests that Beijing sees fleet size as highly relevant to deterrence. The United States does not necessarily need to play China's game here, but it does need a clear idea of how it would deal with the PLAN surface fleet if a war broke out.

The right fleet size for the United States depends principally on fleet composition. In today's force, large warships such as aircraft carriers, destroyers, and cruisers play the most important role in power projection and defense. These vessels are equipped with advanced radar systems, air and missile defenses, and strike capabilities, allowing them to serve as the backbone of more complex fleet actions involving many smaller ships. However, large ships are expensive to build and maintain. When they are damaged, it can take months if not years to repair or replace them. The United States takes two or three years to repair destroyers after collision damage.[51] Combat damage may be more intensive, creating even longer repair times. US maritime infrastructure may be vulnerable to Chinese cyberattacks, disrupting repairs. Damaged carriers are even harder to fix quickly.

There are trade-offs between larger and smaller ships that DMO does not directly address. More expensive warships are obviously more expensive to lose—meaning that US commanders may be more risk-averse in pushing them closer to the action during a kinetic fight in the First Island Chain and Philippine Sea. Smaller surface combatants, such as frigates and corvettes, would seem to offer a more affordable alternative. The Navy's new *Constellation*-class frigates, for example, are designed for antisubmarine warfare (ASW), surface warfare (SUW), and limited air defense.[52] At roughly half the cost of a destroyer, these ships can be produced more quickly, increasing the Navy's overall numbers while enhancing its operational flexibility. However, the *Constellation* class's procurement is already running behind schedule, while the ship has increased in size by 10 percent, making it look more like a traditional destroyer than a small, cheap frigate.[53] Smaller ships also tend to carry fewer munitions and VLS tubes relative to their size and have less sophisticated sensors and defensive systems than larger combatants. Even with extensive power design changes, they are unlikely to generate enough power to use DEWs or rail-guns. Smaller ships are useful for increasing fleet size and providing operational flexibility, but they cannot fully replace the firepower and survivability of larger vessels.

Another relevant consideration is the condition of the US shipbuilding industry, discussed at greater length in chapters 6 and 8.[54] Only a few shipyards remain capable of building large warships.[55] The Navy's reliance on highly advanced, expensive platforms has stretched the capacity of these shipyards and lengthened production timelines. Building larger combatants like destroyers and carriers often takes years. This fact makes it difficult to rapidly expand the fleet or adjust its composition in response to emerging threats. Because China has superior shipbuilding capacity—indicating the ability to reconstitute naval forces in a protracted conflict—the United States faces significant risks if it miscalculates and creates a fleet that is neither resilient for a long war nor adaptable to technological change.

Budgetary constraints are the final consideration in the fleet size debate. The high cost of modern warships, combined with rising personnel and maintenance costs, limits the Navy's ability to build and sustain a larger fleet. Trade-offs between acquiring new ships and maintaining existing ones are inevitable, particularly as older vessels age and require costly overhauls.

The debate over fleet size and composition ultimately hinges on finding the right balance between capability and capacity. The Navy needs enough large surface combatants to maintain robust air and missile defenses, project power, and protect critical assets like carriers. At the same time, it needs smaller, more numerous platforms to disperse forces, complicate enemy targeting, and increase operational flexibility. It also needs enough unmanned ships to handle the adversary's unmanned fleet, defend manned ships, and conduct a variety of missions too risky for manned ships. However, scaling up the unmanned fleet will take more than a decade, and manned and unmanned ships will likely operate together long after that. Given that US planners will gain crucial insights during this evolution, focusing on force adaptability—particularly through investments in industrial capacity—may be wiser than committing prematurely to specific fleet numbers and configurations.

Working with allied shipyards is one way to build this capacity quickly, though contracts would need to be negotiated so that foreign yard operators' incentives are aligned. Specifically, foreign yards have no historical experience contracting directly with the US government. The DOD would need to provide much clearer technical specifications and structure contracts to allow some tolerance for cost overruns.

The Carrier Question

No symbol of American naval power is as iconic as the aircraft carrier. The supercarrier has long been the centerpiece of US military strategy, functioning as a mobile, self-sustaining air base capable of conducting a wide range of missions. Despite historical concerns over their vulnerability—first to nuclear weapons, later to Soviet strike aircraft, and now to long-range precision missiles—carriers have adapted, incorporating advanced defenses and tactics to remain viable in high-end conflicts. Today, the rapid evolution of long-range strike capabilities, particularly by China, has renewed questions about their role.[56] Yet carriers remain highly valued for their ability to deploy both manned and unmanned aircraft across a range of operations, from high-intensity combat to disaster relief, making them essential assets in diverse scenarios. Their mobility also makes them harder to target than fixed installations, and with range extenders like midair refueling, they can project power effectively from great distances.[57]

In the Indo-Pacific, US carriers are critical to deterring China. They serve as mobile airfields that enable the US Navy to maintain a robust presence across the region. They project power into contested areas like the Taiwan Strait, South China Sea, and East China Sea, especially the Senkaku Islands, and they could deploy rapidly and provide sustained air support if a crisis emerged anywhere in these areas. Carriers are also essential for conducting joint and coalition operations, as they regularly participate in exercises with allies like Japan, South Korea, and Australia to enhance interoperability and demonstrate a unified deterrent posture.[58] In high-stakes scenarios, US carriers provide rapid-response capability. Their large air wings and strike group assets—including cruisers, destroyers, and submarines—create layered defenses against anti-ship missiles and undersea attacks.

Beyond the Indo-Pacific, carriers are central to US deterrence against Russia in the Euro-Atlantic theater.[59] In the Atlantic and the Mediterranean, carriers provide NATO with critical flexibility by enabling the rapid redeployment of fighter jets, surveillance, and EW assets to strengthen air defenses along vulnerable Eastern European borders. In the North Atlantic, they conduct air patrols and antisubmarine operations near the Greenland-Iceland-UK (GIUK) gap, a chokepoint crucial for monitoring Russian submarine movement.[60] Operating from the Mediterranean, carriers project power toward NATO's southeastern borders—including Turkey, Bulgaria, and Romania—where Russia's anti-ship missile threats are significant.[61] Although the Montreux Convention restricts naval operations in the Black Sea, a US or allied carrier in the Mediterranean is a valuable rapid-response asset for any crisis nearby.[62] In addition, US carriers help to secure vital sea lanes like the Suez Canal, ensuring that allied forces have uninterrupted access to Europe, the Middle East, and Africa.[63]

Although Britain's two *Queen Elizabeth*–class carriers and France's *Charles de Gaulle* add value to NATO, their design limitations and maintenance cycles restrict their ability to sustain long-term coverage in the Atlantic or Indo-Pacific.[64] The United States cannot assume that more than one British or French carrier will be available at any given time if a crisis with Russia breaks out, since carriers require such frequent and time-intensive maintenance. Integrating allied carriers also requires extensive coordination to align systems and command structures, which could affect response times. Thus, at least one—and potentially two—US carriers probably need to remain available at all times in the Atlantic theater for the foreseeable future.

Congress and the Navy have both made their commitment to carriers clear. The Navy has already deployed one of its new carrier class—the *Gerald Ford*. It will deploy the second, the *Kennedy*, by around 2026. Currently, the Navy is planning for one-for-one replacements for retiring carriers and is on track to completely recapitalize the carrier fleet by the 2040s.[65] For the foreseeable future, the Navy will field ten to twelve full-scale carriers capable of launching aircraft with a catapult and recovering them with an arresting wire.[66] At any given time, three will be on deployment, three under work-ups, and three in refit or overhaul. The remaining two carriers can be used for crisis response, traditional presence missions, and major exercises.[67]

Most planners assess that if the Navy is to maintain a constant carrier presence in the Euro-Atlantic, Persian Gulf, and Indo-Pacific simultaneously, it needs at least eleven carriers.[68] Even a two-hub Navy involving a constant forward presence in both the Atlantic and the Pacific could require some ten or eleven carriers, since any large-scale combat operations would likely involve multiple carriers working together in a larger strike group. Given that Congress has made large investments in the carrier force and seems unlikely to change its mind about the value of carriers in the near future, the key question is how the US carrier fleet can be adapted and made more resilient and operationally relevant.

As we have seen, if DMO is implemented effectively, it will increase the value of carriers by reimagining carrier strike group tactics—even as it shifts the burden of offensive operations away from the air wing alone. In the dispersed, networked fleet of DMO, carriers deploy farther from threats and rely on long-range missiles and robust air defenses instead of requiring a large escort fleet for close protection.[69] This shift not only increases the survivability of carriers themselves but also expands their operational flexibility, allowing them to support multiple offensive and defensive missions at once. It also frees up individual members of the strike group to conduct independent operations, complicating the threat picture for the enemy.[70]

In the medium term, however, while the rest of the force is still being optimized for DMO, carriers face a complex threat environment for the reasons we have explored above. To address the threat posed by China's long-range missiles, the Navy is exploring several adaptations to extend carriers' strike range. One is the MQ-25 Stingray, an unmanned aerial refueling platform to extend the range of carrier-based aircraft.[71] Another is the integration of long-range strike drones and hypersonic weapons into the carrier air wing, which would enable carriers to project power deep into contested areas without risking pilots.[72] A third is an effort to increase supplies of long-range weapons, namely HALO and LRASM, for carrier-based aviation. Air-launched missiles have various advantages over deployed Vertical Launching System (VLS) weapons.[73] Carriers can adapt their aircraft loadout to suit different missions, whether for air superiority, strike operations, or electronic warfare. These technological upgrades, combined with improved missile defense systems and EW, offer ways to mitigate the vulnerability of carriers in high-threat environments while enabling them to deploy lethal force from a safe distance.

Divestment

Although it is too early to declare with confidence the "death of the carrier," several other kinds of surface ship are losing operational relevance. Large warships require long-term contracts and constitute the bulk of the Navy's procurement expenditures. In an era of stretched budgets, it makes no sense to maintain those that would be irrelevant in a fight with China.

Either future surface warships must mount very long-range missiles—allowing them to stay out of range of enemy fire—and maintain robust air defenses, or they must be very small and very cheap. Ships that are hardened against missile attacks or can be retrofitted without great difficulty can defend themselves, particularly with the help of unmanned systems. A sophisticated large warship with ample power generation can operate sophisticated anti-air radar, and in the future it can potentially use DEWs and other techniques to defend itself against incoming attacks while deploying larger missiles to engage the enemy from a greater range.

The *Arleigh Burke*–class destroyer clearly passes this test, but lightly armed surface warships do not.[74] A key example of the latter is the Littoral Combat Ship (LCS), which was designed as a modular system that could operate in multiple contexts. Its passive defenses and damage-control processes are not sufficient to protect against improvised mines, let alone heavy missile strikes. In practice, the ship is not survivable in the Indo-Pacific and there is no good reason to acquire more. The new *Constellation*-class frigate, currently meant to reach the fleet in 2026, also deserves critical scrutiny. At three-quarters of the size of an *Arleigh Burke*, costing over half the price, and without the capacity to field even half the missiles, the *Constellation* offers a poor return on investment. The Navy may be pushed to retire some of these ships early, just as it is doing with the ill-fated LCS program.[75]

A key question will be whether aging specialized warships in the fleet—particularly the Navy's big-deck amphibious assault ships, designed to support marines during beach assaults—can be hardened enough or provided with enough long-range weapons that it is practical to use them in combat. The Navy operates nine big-deck amphibious assault ships—the current *Wasp*-class landing helicopter deck (LHD) and the *America*-class landing helicopter assault (LHA)—each designed to carry roughly one thousand marines and their fixed-wing and rotary wing air support. However, these vessels have many of the disadvantages of a traditional carrier in size, displacing 40,000-50,000 tons, without the complementary advantages. They have flat decks like carriers, but they lack catapults to launch aircraft or arresting hooks to land them. That means they can deploy only aircraft capable of vertical landing, which cannot carry heavy payloads. Their aviation facilities are too small to sustain long-range aircraft or aerial refueling aircraft, making them impractical as small aircraft carriers operating far back from the combat zone.

Amphibious operations will be important in any Indo-Pacific war, but the small watercraft that deploy off LHAs, LHDs, and even the smaller landing platform docks (LPDs) have a range of just 300 kilometers.[76] Existing US amphibious assault ships cannot come within that range of Taiwan or contested islands in the South China Sea without becoming extremely vulnerable to missile strikes.

The Navy and the Marine Corps are developing work-arounds: smaller ships that can deploy independently or off the big-deck ships and move several hundred kilometers forward to the combat zone. The Medium Landing Ship (LSM), formerly called the Light Amphibious Warship, is the Marine Corps' first cut of this concept.[77] With a 5,000-plus-kilometer unrefueled range and the ability to embark a marine anti-ship missile unit, the LSM can transport marines into China's missile bubble and sustain them during combat. Unfortunately, the LSM has the same survivability concerns as the LCS. At around $150 million each, LSMs are cheaper than standard surface combatants but still quite expensive. To keep costs down, they are relatively slow and lightly armored and lack point defenses. The LSM does provide the marines with a high-endurance support vessel that can move units around within the First Island Chain, which a smaller, lighter craft might lack the fuel to do. An alternative is a longer-range Landing Craft Air Cushion (LCAC), the watercraft used to deploy marines to beaches today. The current LCAC replacement program, the Ship-to-Shore Connector (SSC), has experienced major cost overruns, has mechanical issues, and does not provide enough range for long-distance deployment.[78] In the interim, as the Navy and the Marine Corps refine their new amphibious doctrine, larger LSMs and smaller

SSC-like ships will work in tandem. For now, the Navy's mainstay large amphibious ships are reasonable. Any future developments must take into account their vulnerability and ensure that they have transports with sufficient range to deliver troops to shore. Modern amphibious assault ships will need to change their mission set fundamentally or be divested.

Ultimately, a new amphibious assault ship will be necessary. The Forward Afloat Base/Expeditionary Sea Base (ESB) is the Navy's initial solution.[79] These are essentially large commercial tankers, displacing over 100,000 tons and capable of carrying 60,000-plus tons, serving as mobile motherships for smaller warships and amphibious ships.[80] The Navy currently has four of these ships in service, with one under order and another under construction. However, given the precision strike trends discussed in this book, the ESB program may have to be rethought. Amphibious assault operations within the First Island Chain are not viable if US forces are operating out of such easy targets.

Conclusion

The US surface fleet stands at a critical juncture, facing growing threats from China's long-range precision missiles, unmanned systems, and submarines. Extrapolating these trends over a five- to fifteen-year horizon, US planners need to take seriously the possibility that many of its existing surface ships—particularly littoral ships without robust air defenses—will become functionally obsolete in high-intensity conflict scenarios. Without adaptation, the utility of aircraft carriers too could be severely degraded. Carriers will remain valuable since they provide commanders with unparalleled operational flexibility, but the commanders may not be able to use them effectively unless they are prepared to operate them within the range of China's long-range strike. These considerations underscore the importance of maximizing US competitiveness in long-range strike and counter-scouting.

The good news is that naval history suggests that the surface fleet's defensive and offensive adaptations might suffice to keep current platforms relevant for some time to come. Even during rapid paradigm shifts such as the advent of the torpedo, the dreadnought revolution, and the rise of the aircraft carrier, legacy ships remained relevant during the transition. The rise of unmanned platforms also opens the door to a broad universe of adaptation options. It is therefore too early to make a definitive conclusion about the "death of the carrier." Still, it seems imprudent to weigh the shipbuilding budget heavily toward large new ships that cannot defend themselves effectively against long-range precision strike.

Given the enormous uncertainty about the optimal design of the future fleet at this moment of technological inflection, the Navy should consider adopting a medium-term hedging strategy. It should emphasize capacity investments rather than doubling down on a particular vision of the future fleet that pins deterrence on a small number of critical high-tech capabilities. In practical terms, this means maintaining a diverse fleet structure in the short term—combining large surface combatants with smaller distributed platforms, advanced defensive systems, and unmanned technologies. It also means focusing on expanding US and allied industrial *capacity* for building and servicing submarines, effective surface combatants, LCACs and similar small and fast-moving amphibious ships, and unmanned ships of various types. The hedging strategy also involves heavy investments in secure communications, EW, and air and missile defense technologies. The goal should be to make the Navy more agile and adaptable as technology evolves and the answers to key questions become clearer.