

U.S. Navy

In *A Design for Maintaining Maritime Superiority, Version 2.0*, then-Chief of Naval Operations Admiral John M. Richardson describes the U.S. Navy's mission:

The United States Navy will be ready to conduct prompt and sustained combat incident to operations at sea. Our Navy will protect America from attack and preserve America's strategic influence in key regions of the world. U.S. naval forces and operations—from the sea floor to space, from deep water to the littorals, and in the information domain—will deter aggression and enable peaceful resolution of crises on terms acceptable to the United States and our allies and partners. If deterrence fails, the Navy will conduct decisive combat operations to defeat any enemy.¹

For much of the post-Cold War period, the Navy, Marine Corps, and Coast Guard (known collectively as the sea services) have enabled the U.S. to project power across the oceans, control activities on the seas when and where needed, provide for the security of coastlines and shipping in maritime areas of interest, and thereby enhance America's deterrent capability without opposition from competitors. However, the ability of competitors to contest U.S. actions has improved, forcing the sea services to revisit their assumptions about gaining access to key regions.

Together, these functional areas—power projection, sea control, maritime security, deterrence, and domain access—constitute the basis for the Navy's strategy. Achieving and sustaining the ability to excel in these functions drives Navy thinking and programmatic efforts.

As the U.S. military's primary maritime arm, the Navy provides the enduring forward

global presence that enables the United States to respond quickly to crises around the world. Unlike ground or air forces, which operate from fixed, large support bases that require the consent of host nations, the U.S. Navy can operate freely at sea across the globe and shift its presence to wherever it is needed without any other nation's permission. As a result, naval forces are often the first U.S. forces to respond to a crisis and, through their persistent forward deployments, continue to preserve U.S. security interests long after conflict formally ends. The Navy's peacetime forward presence supports missions that include securing sea lines of communication for the free flow of goods and services, assuring U.S. allies and friends, deterring adversaries, and providing a timely response to crises short of war.

A few key documents inform the Navy's day-to-day fleet requirements:

- The 2017 National Security Strategy;²
- The 2018 National Defense Strategy (NDS);³
- The Global Force Management Allocation Plan (GFMAP);⁴ and
- The 2018 *Design for Maintaining Maritime Superiority, Version 2.0*.

The 2018 NDS, issued by the Secretary of Defense, describes 11 Department of Defense (DOD) objectives for the Navy and the other branches of the U.S. military including “defending the homeland from attack; sustaining

Joint Force military advantages, both globally and in key regions; deterring adversaries from aggression against our vital interests; and ensuring common domains remain open and free.”⁵ The NDS also directs the building of a more lethal, resilient, and agile force to deter and defeat aggression by great-power competitors and adversaries in all warfare domains and across the spectrum of military operations.⁶

The U.S. Navy must also meet forward presence requirements laid out in the GFMAP, which specifies the force presence needed around the world as determined by the combatant commanders (CCDRs) and the Secretary of Defense. To meet the objectives of the NDS and GFMAP, according to the Navy’s fiscal year (FY) 2019 budget request, “the Navy and Marine Corps primary combat force contributors are two Carrier Strike Groups (CSG) and two Amphibious Ready Groups (ARG) forward [deployed] at all times, and keeping three additional CSGs and ARGs in a ready use or surge status (2+3) to deploy within 30 days.”⁷

The Navy did not cite this GFMAP in its FY 2020 budget documents or congressional testimony,⁸ but there is no indication that this requirement has been reduced. When questioned during an appearance before a subcommittee of the House Armed Services Committee about the Navy’s ability to maintain two aircraft carriers deployed and an additional three aircraft carriers available to deploy “during potential times of conflict,” Vice Admiral William Merz, Deputy Chief of Naval Operations for Warfare Systems (OPNAV N9), responded that “those numbers are actually sensitive.”⁹

According to the Navy’s March 2019 report to Congress on its long-range plan for construction of naval vessels, “The *Navy Strategy* articulates the maritime implementation of the *National Defense Strategy* and includes three driving elements of readiness, capability and capacity, all of which must remain balanced and scalable in order to field credible naval power.”¹⁰ This *Index* focuses on these elements as the primary means by which to measure U.S. naval strength.

- Capacity must be sufficient both to defeat adversaries in major combat operations and to provide a credible peacetime forward global presence to maintain freedom of the global shipping lanes and deter aggression.
- Naval ships, submarines, and aircraft must possess the most modern warfighting capabilities, including weapons, radar, and command and control systems, to maintain a competitive advantage over potential adversaries.
- Finally, these naval platforms must be properly maintained, and their sailors must be adequately trained to ensure that they are “ready to fight tonight.”

Failure in any one of these critical measures of performance drastically increases the risk that the U.S. Navy will not be able to succeed in its mission and ensure the security of the nation and its global interests. For example, if the fleet is sufficiently large but has out-of-date equipment and weapons, and if its sailors are not proficient at warfighting, the Navy will fail to deter adversaries and will be unable to succeed in battle.

Capacity

The Navy measures capacity by the number of ships rather than the number of sailors, and it does not count all ships equally. For example, the capabilities and contribution to combat operations of an aircraft carrier and its associated air wing are significantly greater than those of a littoral combat ship (LCS). The Navy focuses mainly on the size of its “battle force,” which is composed of ships that it considers to be directly related to its combat missions.¹¹

This *Index* employs a benchmark of 400 ships for the minimum battle force fleet required to handle two simultaneous or nearly simultaneous major regional contingencies (MRCs), with a 20 percent additional margin that serves as a strategic reserve, while also maintaining a peacetime global forward

Carrier Strike Group

A Carrier Strike Group (CSG) is a principal element of U.S. power projection, conducting missions such as sea control, offensive strike, and air warfare.

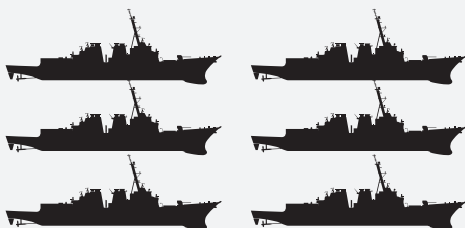


Aircraft Carrier (CVN)

Capable of supporting combat operations for a carrier air wing of at least 70 aircraft, providing sea-based air combat and power projection capabilities that can be deployed anywhere in international waters.

Guided Missile Destroyer (DDG)

Surface combatant capable of conducting integrated IAMD, AAW, ASuW, and ASW.



Guided Missile Cruiser (CG)

Large surface combatant (LSC) capable of conducting integrated air and missile defense (IAMD), anti-air warfare (AAW), anti-surface warfare (ASuW), and anti-submarine warfare (ASW). CGs are the preferred platform for serving as the Air and Missile Defense Commander.



Guided-Missile Frigate FFG(x)

Multi-mission small surface combatant (SSC) designed to complement the ASuW and ASW capabilities of the CSG as well as serve as a force multiplier for air defense capable DDGs.



Attack Submarine (SSN)

Multimission-capable submarines capable of performing ASW and ASuW in defense of the CSG.



Logistics Ship

Provides fuel, dry stores, and ammunition in support of CSG operations.

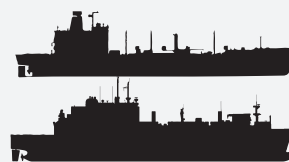


FIGURE 5

Expeditionary Strike Group

An Expeditionary Strike Group (ESG) is the primary element of U.S. amphibious warfare and expeditionary operations.



Amphibious Assault Ship LHA or LHD

A landing helicopter assault ship (LHA) or landing helicopter dock (LHD). Capable of supporting short take-off vertical landing (STOVL) operations for embarked Marine strike aircraft squadron as well as tilt-rotor and helicopter squadrons. Some of these ships possess a well deck to launch landing craft to support ship to shore transport of Marines.

Amphibious Transport Dock (LPD), and Amphibious Dock Landing Ship (LSD)

Embarked landing craft and amphibious assault vehicles (AAV) augmented by helicopters and tilt-rotor aircraft use LPDs and LSDs to transport and land Marines, and their equipment and supplies.



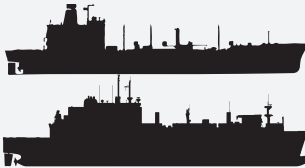
Guided Missile Destroyer (DDG)

LSC capable of conducting integrated IAMD, AAW, ASuW, and ASW.



Logistics Ship

Provides fuel, dry stores, and ammunition in support of CSG operations.



Guided-Missile Frigate FFG(x)

Multimission small surface combatant (SSC) designed to complement the ASuW and ASW capabilities of the CSG as well as serve as a force multiplier for air defense capable DDGs.



SOURCE: Heritage Foundation research.

presence to deter potential aggressors and assure our allies and maritime partners that the nation remains committed to defending its national security interests and alliances. The analysis that determined this minimum battle force fleet included an independent review of previous force structure assessments, historical naval combat operations, Navy and Marine Corps guidance on naval force composition, current and near-future maritime threats, U.S. naval strategy, and enduring naval missions.

This *Index* assesses that a minimum of 400 U.S. Navy battle force ships is required to provide:

- The 13 carrier strike groups and 15 expeditionary strike groups (ESGs) required to meet the simultaneous two-MRC construct;
- The historical steady-state demand of approximately 100 ships constantly forward deployed in key regions around the world; and
- Sufficient capacity to maintain the Navy's ships properly and ensure that its sailors are adequately trained to "fight tonight."

While this represents a significant increase from the language of the FY 2018 National Defense Authorization Act (NDAA), which specified an official U.S. policy of "not fewer than 355 battle force ships,"¹² and the Navy's own 2016 Force Structure Assessment (FSA),¹³ both the Navy's recent fleet readiness issues and the 2018 NDS's focus on the "reemergence of long-term strategic competition"¹⁴ point to the need for a much larger and more capable fleet.

The vast distances of the world's oceans and the relatively slow average transit speeds of naval warships (15 knots) require that the U.S. Navy maintain sufficient numbers of ships constantly forward deployed in key regions around the world to respond quickly to crises and deter potential aggression. This larger fleet includes not only additional small surface combatants (SSCs) to support the strike

groups, but also a significant increase in combat logistics force (CLF) ships to ensure that distributed forces deployed in peacetime and in combat operations can receive timely fuel, food, and ammunition resupply.

On average, four ships in the fleet are required to maintain one ship forward deployed. Most important, the fleet must be large enough to provide the requisite number of CSGs and ESGs when called upon as the primary elements of naval combat power during an MRC operation. Although a 400-ship fleet may be difficult to achieve based on current DOD fiscal constraints and the present capacity of the shipbuilding industrial base, this *Index* benchmark is budget agnostic and based strictly on assessed force-sizing requirements.

As of August 12, 2019, the Navy sailed 290 vessels as part of its battle force fleet,¹⁵ up from 284 in 2018¹⁶ but still well below both the Navy's goal of 355 ships and the 400-ship fleet required to fight and win two MRCs. The FY 2019 NDAA provides \$22.3 billion for the construction of 13 new ships, including (among others listed) three littoral combat ships (LCS); three Flight III *Arleigh Burke* guided missile destroyers (DDG); two fast replenishment oilers (T-AO); expeditionary fast transport (T-EPF); and one towing, salvage, and rescue ship (T-ATS).¹⁷ The Navy has requested the procurement of 12 ships in FY 2020, marking the "largest shipbuilding budget request in over 20 years."¹⁸

On average, depending on the ship class, a ship is commissioned and joins the fleet three to five years after it is purchased by the Navy. The Navy plans to commission seven additional ships and submarines by the end of 2019 and 10 ships and submarines in FY 2020, including four *Arleigh Burke*-class DDGs, three *Virginia*-class nuclear attack submarines (SSNs), two LCSs, and one T-EPF.¹⁹ The Navy will also retire five battle force ships in FY 2020: two *Los Angeles*-class SSNs and three mine countermeasure ships (MCMs).²⁰

The number of ships decommissioned will increase significantly over the next five years as additional *Los Angeles*-class SSNs and MCMs reach the end of their service lives. The recent

Navy decision to retire eight *Ticonderoga*-class guided missile cruisers instead of conducting service life extensions (SLEs) will further slow the pace at which fleet size can grow.²¹ The Navy completed a technical evaluation of the “feasibility of extending the service life of selected non-nuclear vessels” in 2018 and could decide to extend the life of ships from several classes from seven to 17 years depending on the funding available and shipyard capacity to achieve and maintain a 355-ship Navy more rapidly by reducing ships lost to decommissioning.²²

The largest proportional shortfall in the Navy fleet assessed in the *2020 Index* is the same as in the past five editions: small surface combatants.²³ As of August 20, 2019, the Navy’s SSC inventory included 19 LCSs and 11 MCM ships for a total of 30 SSCs,²⁴ 22 below the objective requirement of 52 established by the Navy²⁵ and 41 less than the *Index* requirement of 71.²⁶

The next-largest shortfall occurs in combat logistics force ships. As of August 20, 2019, the Navy’s CLF inventory was comprised of 12 *Lewis and Clark*-class dry cargo and ammunition ships (T-AKES); 15 *Henry J. Kaiser*-class fleet replenishment oilers (T-AOs); and two *Supply*-class fast combat support ships (T-AOEs), for a total of 29 CLF ships.²⁷ This is three below the Navy requirement of 32 ships and 25 less than the *Index* requirement of 54.²⁸

As of August 20, 2019, the Navy’s attack submarine inventory stood at 50 submarines, comprised of 30 *Los-Angeles*-class (SSN 688); three *Seawolf*-class (SSN 21); and 17 *Virginia*-class (SSN 774) submarines.²⁹ Although the attack submarine shortfall is not the largest in comparison to the Navy’s requirement of 66 submarines³⁰ or the Heritage requirement of 65 submarines,³¹ several factors make this the most challenging and most important force level issue for the Navy.

- The growing anti-access/area denial (A2/AD) capabilities of great-power competitors like China and the ability of submarines to penetrate these long-range defenses have made attack submarines a

critical component of joint force missions such as power projection and sea control.

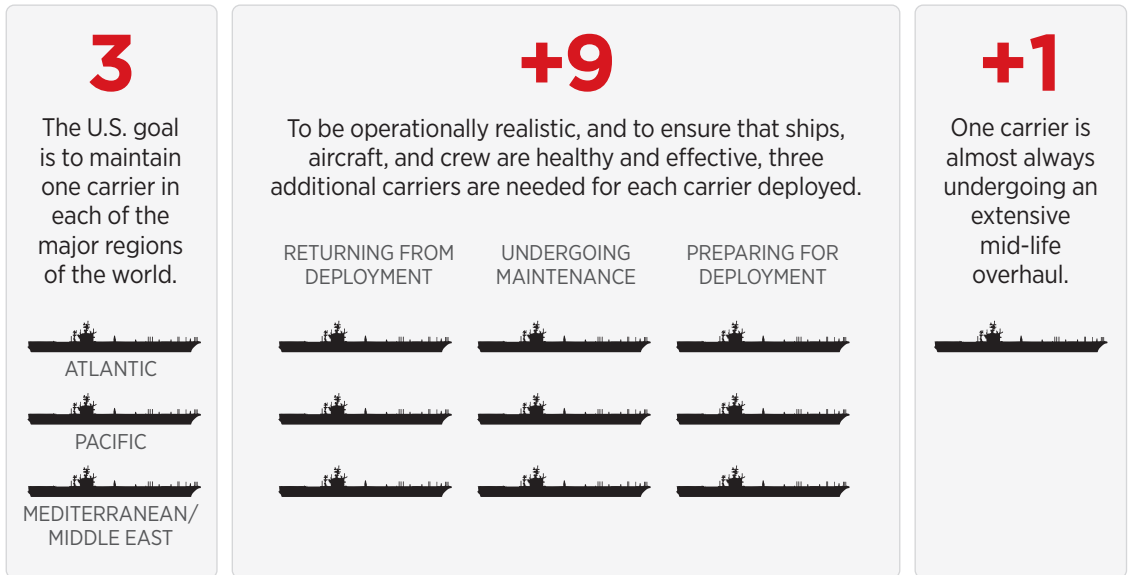
- Geographic combatant commanders have repeatedly expressed concerns that the Navy cannot meet their operational demands for attack submarines. Admiral Philip Davidson, Commander, U.S. Indo-Pacific Command, has stated that his Pacific forces receive only slightly more than 50 percent of their submarine mission requests.³² The submarine force also gives the U.S. military its greatest competitive advantage against great-power competitors Russia and China.
- The submarine industrial base has very limited excess capacity over the next 30 years to accelerate the production of attack submarines. The Navy’s FY 2020 30-year shipbuilding plan identified opportunities to build only three additional *Virginia*-class submarines over the next six years and an additional nine next-generation SSNs between FY 2037 and FY 2049.³³

The aircraft carrier force suffers a capacity shortfall of two hulls: As of August 20, 2019, 11 were in the fleet, and the two-MRC construct requires 13.³⁴ Current U.S. law requires the Navy to maintain a force of “not less than 11 operational aircraft carriers.”³⁵ The FY 2019 NDAA explicitly specifies “the sense of Congress that the United States should accelerate the production of aircraft carriers to rapidly achieve the Navy’s goal of having 12 operational aircraft carriers.”³⁶

The Congressional Research Service (CRS) has assessed that “shifting carrier procurement to 3- or 3.5-year centers could achieve a 12-carrier fleet as soon as the 2030s, unless the service lives of one or more existing carriers were substantially extended.”³⁷ The Navy’s FY 2029 budget “supports 11 aircraft carriers and 33 large amphibious ships that serve as the foundation upon which our carrier strike groups and amphibious ready groups are based.”³⁸

The Case for 13 Carriers

The U.S. Navy carrier fleet is a critical element of U.S. power projection and supports a constant presence in regions of the world where permanent basing is limited. To handle this large mission properly, Heritage Foundation experts recommend a fleet of 13 carriers.



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The carrier force fell to 10 between December 2012 and July 2017. The USS *Gerald R. Ford* (CVN-78) was commissioned on July 22, 2017, returning the Navy's carrier force to 11 ships. While the *Ford* is now part of the fleet battle force, however, it will not be ready for routine flight operations until 2020 and will not operationally deploy until 2022.³⁹ In addition, through 2037, one *Nimitz*-class carrier at a time will be in a four-year refueling and complex overhaul (RCOH) to modernize the ship and refuel the reactor to support its full 50-year service life. The carrier in RCOH will count as a battle force ship but will not be operationally deployable during this four-year period. The combination of these two factors means that only nine aircraft carriers will be operationally available until 2022.

The Navy's FY 2020 budget request is notable for its apparent contradiction regarding the required size of its aircraft carrier fleet. On the one hand, the budget included a two-ship aircraft carrier procurement of CVN 80 and CVN 81 in FY 2020, realizing an estimated \$3.9 billion in savings over buying the ships separately.⁴⁰ The Navy simultaneously announced its decision to cancel the previously planned RCOH for USS *Harry S. Truman* (CVN 75), retiring the ship with over 24 years of service life remaining as well as deactivating one carrier air wing. The Navy's FY 2020 30-year shipbuilding plan stated that this decision was "in concert with the Defense Department's pursuit of a more lethal balance of high-end, survivable platforms (e.g. CVNs) and complementary capabilities from emerging technologies."⁴¹

According to Vice Admiral Merz, the decision to retire USS *Truman* was “not a warfighting decision. It was more of an investment decision.”⁴²

Navy officials declared that canceling USS *Truman*’s refueling overhaul would save \$3.4 billion over the FY 2020–FY 2024 period and a total of \$5.6 billion. When factoring in the cost to retire and dismantle the aircraft carrier as well as funds already spent on the replacement reactor cores, the net estimated savings is closer to \$3.5 billion. The Navy’s FY 2020 budget redirected these savings to fund the development and fielding of new lethal technologies such as directed energy weapons, hypersonic missiles, artificial intelligence, and unmanned systems. Navy leadership also cited the more modern *Ford*-class aircraft carrier’s increased lethality and power generation, 33 percent higher sortie rate, a smaller crew with approximately 600 fewer sailors, two and a half times greater electrical power, and over \$4 billion in life-cycle cost savings over the *Nimitz*-class as additional reasons for prioritizing the two-carrier buy over refueling USS *Truman*.⁴³

The decision to retire *Truman* engendered significant bipartisan opposition from Congress. The Administration subsequently reversed its decision to decommission *Truman*, and Vice President Mike Pence made an official announcement on April 30, 2019, onboard the carrier.⁴⁴ On May 7, 2019, Under Secretary of the Navy Thomas Modly stated “that it is still ‘TBD’ regarding what cuts would be made to pay for the RCOH over the next several years, but he added that the Navy and the Office of the Secretary of Defense are looking across all the services’ budgets for options.”⁴⁵

According to the CRS, “the Navy states that the CVN-75 RCOH can no longer begin in FY2024, as planned prior to the Navy’s FY2020 budget submission, because the Navy spent the months prior to April 30 planning for the ship’s deactivation rather than for giving it an RCOH.”⁴⁶ Since *Truman*’s refueling overhaul will now begin in FY 2025, its proposed funding profile will commence in FY 2021. The Navy will only need an additional \$16.9 million

in its FY 2021 budget, but the required funding will increase to \$234.7 million in FY 2022 with an additional \$1.3 billion in FY 2023 and FY 2024.⁴⁷ Without increased funding beginning in FY 2021, the Navy will be forced either to make cuts in its shipbuilding plan or to curtail the development of the new lethal technologies for which the planned savings were earmarked.

In December 2016, the U.S. Navy released its latest study of forecasted fleet requirements. The Navy Force Structure Assessment was developed to determine the correct balance of existing forces for “the ever-evolving and increasingly complex maritime security threats the Navy is required to counter in the global maritime commons.”⁴⁸ The Navy concluded that a 653-ship force would be necessary to address all of the demands registered in the FY 2017 Global Force Management (GFM) system and that a fleet of 459 ships (200 fewer than the ideal fleet but thought still to be too expensive given current and projected limits on defense spending) would meet warfighting requirements but also accept risk in providing continual presence missions.⁴⁹

The Navy’s final force objective of 355 ships as recommended by the FSA is based on a minimum force structure that “complies with current defense planning guidance,” “meets approved Day 0 and warfighting response timelines,” and “delivers future steady state and warfighting requirements...with an acceptable degree of risk.”⁵⁰ This is an increase of 47 in the minimum number of ships from the previous requirement of 308. The most significant increases are:

- Aircraft carriers, from 11 to 12;
- Large surface combatants (guided missile destroyers (DDGs) and cruisers (CGs)) from 88 to 104 “to deliver increased air defense and expeditionary BMD [ballistic missile defense] capacity and provide escorts for the additional Aircraft Carrier”;
- Attack submarines (SSNs), from 48 to 66 to “provide the global presence required

to support national tasking and prompt warfighting response”; and

- Amphibious ships, from 34 to 38.⁵¹

Section 1025 of the FY 2018 National Defense Authorization Act states in part that “[i]t shall be the policy of the United States to have available, as soon as practicable, not fewer than 355 battle force ships, comprised of the optimal mix of platforms, with funding subject to the availability of appropriations or other funds.”⁵² According to the Navy’s long-range plan for construction of naval vessels:

In response to the latest *National Defense Strategy*, *Navy Strategy* and *CNO’s Design for Maintaining Maritime Superiority 2.0*, the Navy is on track to complete the next FSA by the end of 2019. Some of the key elements that will be reviewed include ongoing threat-based fleet architecture review, logistics in support of DMO [distributed maritime operations], surface ship mix with the inclusion of the new frigate, deterrence per the *National Defense Strategy*, and legacy capital investments versus the efficacy of next generation capabilities.⁵³

Remarks by Navy leadership during congressional testimony have indicated that the new FSA will likely result in a force-level requirement of 355 ships or more. The mix of ship types is also expected to change to provide an increased number of small surface combatants (frigates) and logistics ships to support more dispersed maritime operations.⁵⁴

The 2019 FSA may discuss unmanned ships and undersea vehicles but almost certainly will not establish an unmanned force size or replace manned ships with unmanned vessels. The FY 2020 30-year shipbuilding plan, however, does address unmanned and optionally manned systems and the battle force:

The physical challenges of extended operations at sea across the spectrum of

competition and conflict, the concepts of operations for these platforms, and the policy challenges associated with employing deadly force from autonomous vehicles must be well understood prior to replacing accountable battle force ships.⁵⁵

The Navy’s FY 2020 30-year shipbuilding plan provides the foundation for building the Navy the nation needs and ultimately achieving the congressionally mandated requirement of 355 battle force ships. Specifically, it states that “[t]he PB2020 30-year shipbuilding plan includes procurement of 55 battle force ships within the FYDP” and that “[o]verall inventory will reach 314 ships by FY2024 and 355 ships in FY2034.”⁵⁶ The FY 2019 plan also buys 55 ships over the FY 2020–FY 2024 period but builds only 301 ships over the next 30 years.⁵⁷

Although the FY 2020 plan achieves 355 ships by FY 2034, approximately 20 years earlier than would be the case under the FY 2019 plan, this is done primarily by extending the service lives of all *Arleigh Burke*-class DDGs to 45 years, not by increasing the numbers of new ships.⁵⁸ This 355-ship fleet will not possess the desired force mix as defined in the 2016 FSA. It will consist of significantly more large surface combatants than needed (i.e., destroyers and cruisers) but will have fewer aircraft carriers, attack submarines, and amphibious ships than required.⁵⁹

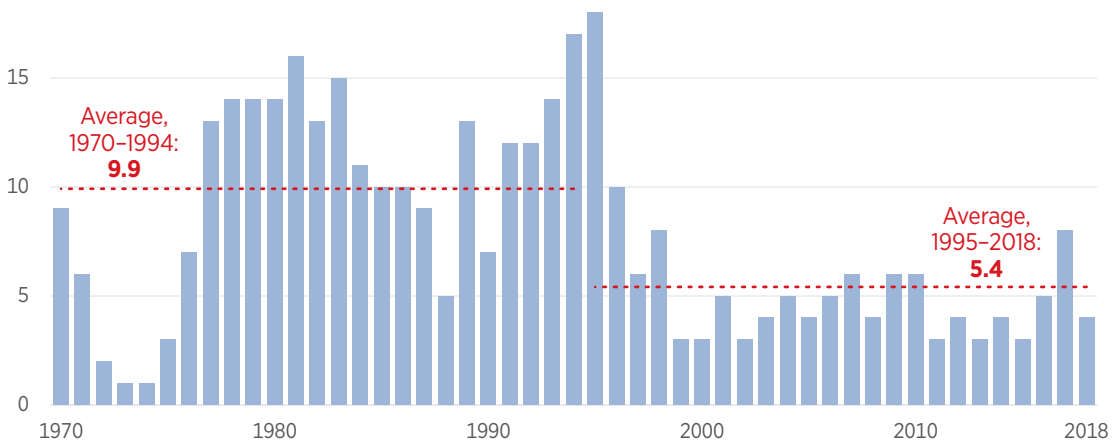
The FY 2020 shipbuilding plan also includes several significant changes in the Navy’s shipbuilding profile over the next five years. It accelerates the acquisition of CVN-81 from FY 2023 to FY 2020 while adding an additional *Virginia*-class submarine and FFG(X) frigate. The plan also decreases the number of LPD-17 Flight II amphibious warships purchased over the next five years from four to two.⁶⁰

The 30-year shipbuilding plan also includes service life extensions for qualified candidate vessels as a key tool with which to increase fleet size more rapidly. The Navy’s FY 2019 budget submission included SLEs for six *Ticonderoga*-class cruisers, four mine countermeasures ships, and “the first of potentially five” *Los*

Rate of U.S. Navy Ship Commissionings Nearly Cut in Half

The U.S. Navy must commission an average of 14 ships annually to reach a 400-ship Navy by the late-2030s. Its current commissioning rate is about 5 ships annually.

20 ANNUAL COMMISSIONINGS



SOURCE: Shipbuilding History, “Large Naval Ships and Submarines,” <http://www.shipbuildinghistory.com/navalships.htm> (accessed August 8, 2018).

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Angeles-class attack submarines.⁶¹ On April 12, 2018, Vice Admiral Merz informed the House Armed Services Seapower and Force Projection Subcommittee that the Navy will extend the entire *Arleigh Burke* destroyer class to a service life of 45 years.⁶²

While the FY 2020 shipbuilding plan includes the DDG-51-class life extension and plans to refuel two *Los Angeles*-class attack submarines over the next five years, it also removes funding for the SLEs for the six oldest *Ticonderoga*-class cruisers “in favor of readiness and other lethality investments.”⁶³ In April 2019, Admiral Richardson stated that “[w]e’re going to continue to assess the cruisers...and study that to see if it is a good return on the taxpayer’s investment, given the war-fighting punch they bring.”⁶⁴ The cost of modernizing the combat systems and key equipment must be weighed against the increased lethality provided by the life extension as well as the fact that *Ticonderoga*-class cruisers have

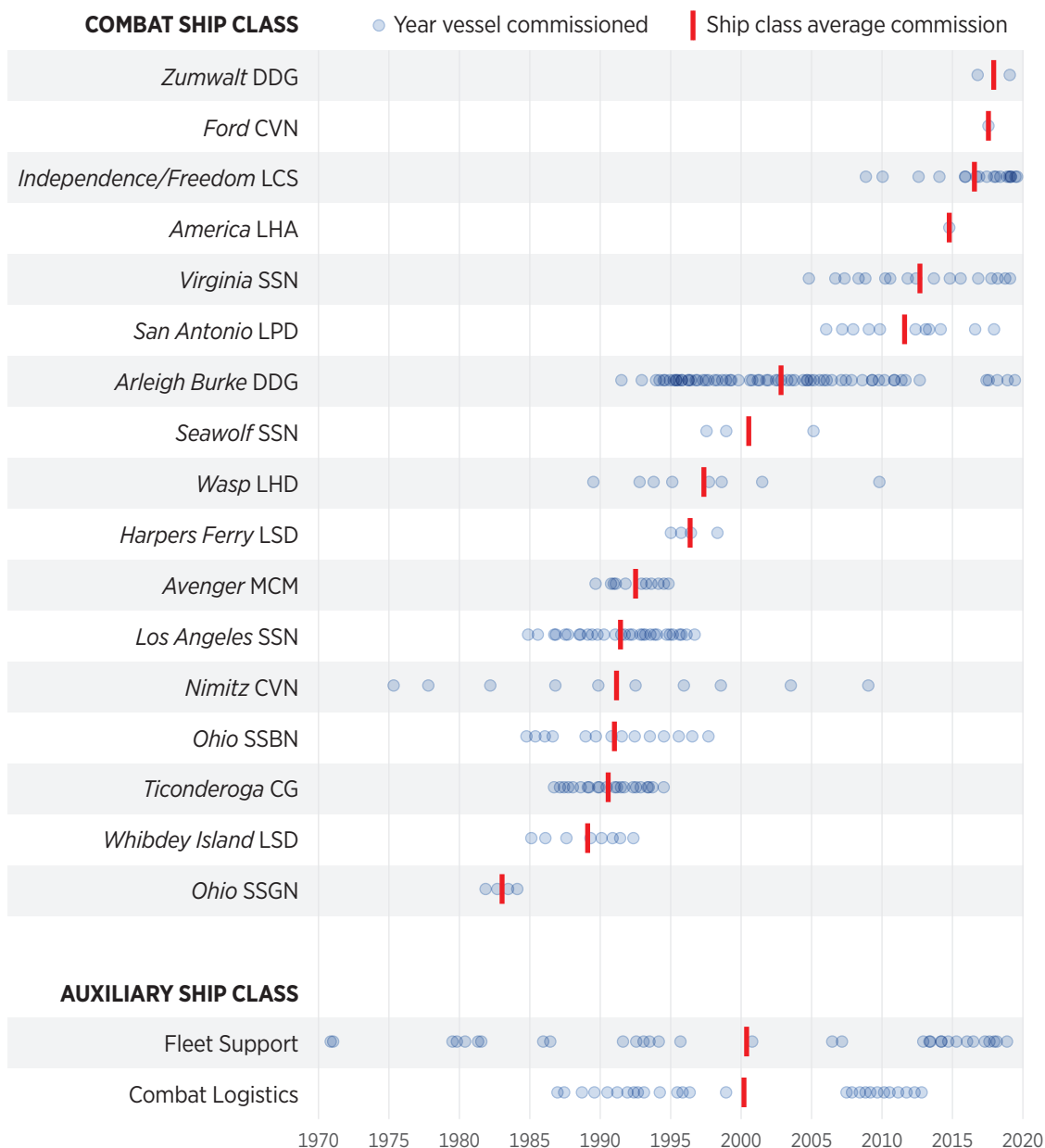
26–32 more vertical launch system (VLS) cells than *Arleigh Burke*-class destroyers have.

The FY 2020 plan also removes the planned life extensions for four MCM ships and accelerates the retirement of all *Avenger*-class MCMs by FY 2023.⁶⁵ The Navy states that its transition to “a broad-spectrum, cross-domain, expeditionary approach that includes dedicated LCS-based MCM ships, MCM modules for use aboard Vessels of Opportunity (VOO), small expeditionary MCM teams, and undersea vehicles” supports this accelerated transition from legacy MCM ships.⁶⁶

The mine mission package aviation assets have been certified for operation on *Independence*-variant LCS ships, and certification of *Freedom*-variant ships should occur by the end of FY 2019. Certification of additional undersea MCM assets on *Independence* variants is expected by the end of FY 2019 and on *Freedom* variants by FY 2020. The complete mine mission packages will not reach initial

Length of Service Since Commissioning

The number and types of ships commissioned by the U.S. Navy has decreased over the past 20 years. The procurement holiday of the 1990s and decreased emphasis on modernization in a time of fiscal constraints have resulted in a fleet of increasing age.



NOTE: Data are current as of September 13, 2019.

SOURCE: Naval Sea Systems Command, Naval Vessel Register, "Fleet Size,"

<http://www.nvr.navy.mil/NVRSHIPS/FLEETSIZE.HTML> (accessed September 13, 2019).

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operating capability (IOC) until FY 2022 at the earliest.⁶⁷ Additional testing and certification delays could cause the Navy to lose a certified and fully operational MCM capability beginning in FY 2023.

Taken alone, total fleet size can be a misleading statistic; related factors must also be taken into account when considering numbers of ships. One such important factor is the number of ships that are forward deployed to meet operational demands. On average, the Navy maintains approximately 90–100 ships (one-third of the total fleet) deployed at any given time. The type or class of ship is also important. Operational commanders must have the proper mix of capabilities deployed to enable a timely and effective response to emergent crises.

Not all ships in the battle force are at sea at the same time. The majority of the fleet is based in the continental United States (CONUS) to undergo routine maintenance and training, as well as to limit deployment time for sailors. However, the CCDRs' requirements for naval power presence in each of their regions provide an impetus to have as many ships forward deployed as possible.

In November 2014, the Navy established an Optimized Fleet Response Plan (OFRP) "to ensure continuous availability of manned, maintained, equipped, and trained Navy forces capable of surging forward on short notice while also maintaining long-term sustainability of the force."⁶⁸ The plan incorporates four phases of ship availability/maintenance that result in a basic ratio of 4:1 for CONUS-based force structure required for deployed platforms.

In 2019, the Navy had 104 ships deployed globally, including submarines.⁶⁹ This represented 36 percent of the total battle force fleet. As of August 9, 2019, the Navy had 76 "Deployed Battle Force Across the Fleet Including Forward Deployed Submarines."⁷⁰ While the Navy remains committed to deploying roughly a third of its fleet at all times, capacity shortages have caused the current fleet to fall below the levels needed to fulfill the Navy's stated forward presence requirements and below

the levels needed for a fleet that is capable of projecting power at the two-MRC level.

The Navy has attempted to increase forward presence by emphasizing non-rotational deployments (having a ship "homeported" overseas or keeping it forward stationed):⁷¹

- **Homeported:** The ships, crew, and their families are stationed at the port or based abroad.
- **Forward Stationed:** Only the ships are based abroad while crews are rotated out to the ship.⁷² This deployment model is currently used for LCS and SSGNs manned with rotating blue and gold crews, effectively doubling the normal forward deployment time.

Both of these non-rotational deployment options require formal agreements and cooperation from friends and allies to permit the Navy's use of their facilities, as well as U.S. investment in additional facilities abroad, but they also allow one ship to provide a greater level of presence than can be provided by four ships based in CONUS and in rotational deployment because they offset the time needed to deploy ships to distant theaters.⁷³ The Navy's GFM planning assumptions assume a forward deployed presence rate of 19 percent for a CONUS-based ship compared to a 67 percent presence rate for an overseas-homeported ship.⁷⁴

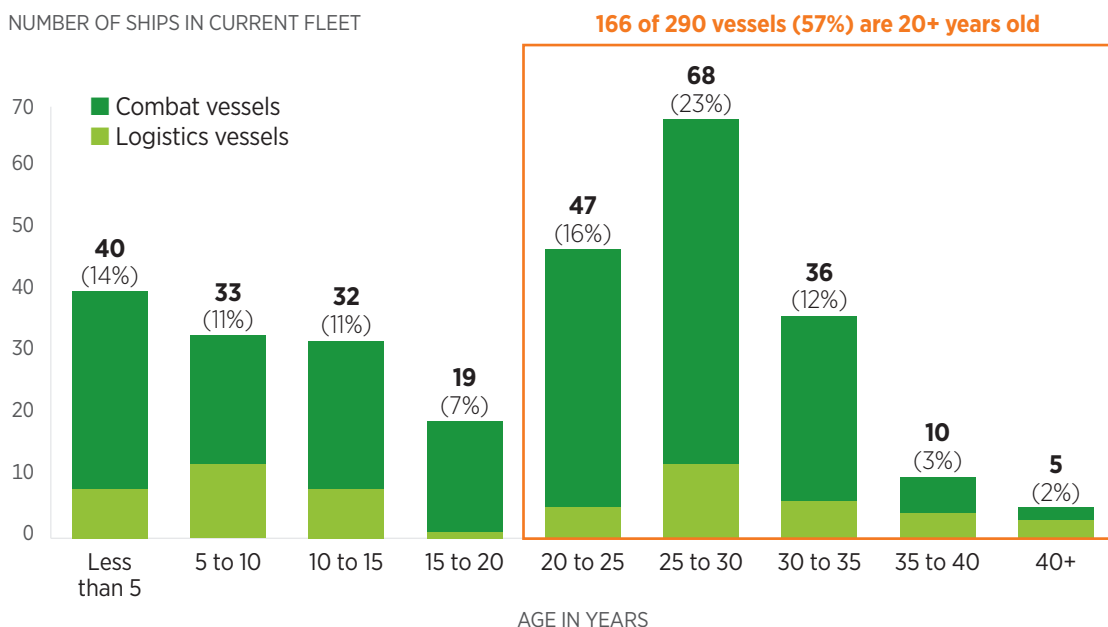
Capability

Scoring the U.S. Navy's overall ability to protect U.S. interests globally is not simply a matter of counting the fleet. The quality of the battle force is also important in determining naval strength.

A comprehensive measure of platform capability would involve a comparison of each ship and its weapons systems relative to the military capabilities of other nations. For example, a complete measure of naval capabilities would have to assess not only how U.S. platforms would match up against an enemy's

An Aging U.S. Navy

NUMBER OF SHIPS IN CURRENT FLEET



NOTE: Data are current as of September 13, 2019.

SOURCE: Naval Sea Systems Command, Naval Vessel Register, "Fleet Size,"

<http://www.nvr.navy.mil/NVRSHIPS/FLEETSIZE.HTML> (accessed September 13, 2019).

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weapons, but also whether formal operational concepts would be effective in a conflict, after which the assessment would be replicated for each potential conflict. This is a necessary exercise and one in which the military currently engages, but it is beyond the scope of this *Index* because such details and analysis are routinely classified.

Capability can be usefully assessed based on the age of ships, modernity of the platform, payloads and weapons systems carried by ships, and the ability of planned modernization programs to maintain the fleet's technological edge. The Navy has several classes of ships that are nearing the end of their life spans, and this will precipitate a consolidation of ship classes in the battle force.

Most of the Navy's battle force fleet consists of legacy platforms. Of the 20 classes of ships in the Navy's inventory, only eight are

currently in production. For example, 61 percent of the Navy's attack submarines are *Los Angeles*-class submarines, an older platform that is being replaced by the more modern and capable *Virginia*-class.⁷⁵

The 30-year shipbuilding plan is not limited to programs of record and assumes procurement programs that have yet to materialize. Some of the Navy's ship designs in recent years, such as the *Gerald R. Ford*-class aircraft carrier, the *San Antonio*-class amphibious ship, and the littoral combat ship, have been substantially more expensive to build than the Navy originally estimated.⁷⁶ The first ship of any class is typically more expensive than early estimates project, which is not entirely surprising given the technology assumptions and cost estimates that must be made several years before actual construction begins. In fact, only two of the last 11 lead ships have come in below the

original cost estimate.⁷⁷ In addition, the Navy is acting to ensure that critical technologies are fully mature (T-AO 205 *John Lewis*-class fleet replenishment oiler) before incorporation into ship design and requiring greater design completion (83 percent for *Columbia* ballistic missile submarine) before actual production.⁷⁸

The Navy retired its last *Oliver Hazard Perry*-class guided missile frigates in 2015 and since then has been without a multi-mission SSC that can perform anti-submarine warfare (ASW); surface warfare (SUW); and local air defense in support of CSGs and ESGs and as a logistic fleet escort. The littoral combat ship is the only current SSC in the fleet other than the MCM ships.⁷⁹

The Navy recently awarded Raytheon the LCS's over-the-horizon anti-ship (OTH) weapon contract to provide an unspecified number of the Kongsberg-designed naval strike missiles.⁸⁰ This encapsulated anti-ship and land attack missile has a range of up to 100 nautical miles and will provide a significant increase in the LCS's offensive capabilities.⁸¹

Critics of the LCS program have continued to express concerns about “past cost growth, design and construction issues with the first LCSs”; “the survivability of LCSs (i.e., their ability to withstand battle damage)”; “whether LCSs are sufficiently armed and would be able to perform their stated missions effectively”; and “the development and testing of the modular mission packages for LCSs.”⁸² The annual report from DOD's Director, Operational Test and Evaluation (DOT&E), has contained numerous comments, many of them extremely critical, regarding LCS operational performance and LCS mission modules.⁸³

The LCS concept of operations (CONOPS) has been modified several times since its original design. The Navy's current plan calls for three divisions on each coast of the United States, each with four ships dedicated to a specific mission: ASW, SUW, or MCM.⁸⁴ One ship in each division will be dedicated to training, and the other three ships will conduct periodic operational deployments.⁸⁵ The non-training ships will be operated by dual crews, similar to

U.S. ballistic missile submarines. This enables the Navy to keep the ships forward deployed longer than the typical seven months without overtaxing their crews. The Navy predicts that by approximately FY 2023, 13 of the 24 ships in the six mission divisions will be maintained forward stationed for 24 months on a rotational basis: three in Singapore, three in Sasebo, Japan, or another Western Pacific location, and seven in Bahrain.⁸⁶

The modular LCS design depends on mission packages (MPs) to provide warfighting capabilities in the SUW, ASW, and MCM mission areas. Until the MPs have reached IOC, LCS will not reach its full warfighting capability. The gun and maritime security mission modules of the SUW MP reached IOC in FY 2014 and FY 2015. The surface-to-surface mission module with the Longbow Hellfire missile reached IOC for the *Freedom*-variant ships in early FY 2019 and is expected to reach IOC for the *Independence* variant by late FY 2019. The ASW MP is scheduled to reach IOC in FY 2020, a delay from FY 2019 caused by Congress's decision to cut all funding for variable-depth sonar procurement in FY 2019.⁸⁷

Originally planned as the first MP to reach IOC, the MCM MP will now be the last to reach IOC with all of its capabilities. The MCM MP aviation assets have been certified for operation on *Independence*-variant LCS ships; the *Freedom*-variant ships should be certified by the end of 2019. Additional undersea MCM assets certification should be complete by the end of 2019 for *Independence* variants and by the end of 2020 for *Freedom* variants. The complete mine mission packages will not reach initial operating capability until 2022 at the earliest.⁸⁸ While the LCS mission modules have had numerous technical problems and delays during their development, congressional cuts between FY 2015 and FY 2018 have only compounded the delays in delivering operational mission packages to the fleet.⁸⁹

After not deploying any LCSs in FY 2018, Vice Admiral Richard Brown, Commander of Naval Surface Forces, announced that the Navy would deploy three LCSs in FY 2019.

The Independence-variant USS *Montgomery* (LCS-8) and USS *Gabrielle Giffords* (LCS-10) from the San Diego-based Littoral Combat Ship Squadron-1 (LCSRON-1) will deploy to the Western Pacific. The Navy did not state where the Freedom-variant USS *Detroit* (LCS-7) from Mayport-based LCSRON-2 would deploy. Based on the long-term plan to forward station seven LCSs in Bahrain, as well as the threat posed by Iranian fast attack craft (FAC) and fast inshore attack craft (FIAC), *Detroit* will likely deploy to Bahrain. All three LCSs will deploy with the SUW MP to address lower-threat missions and alleviate some of the operational demand on U.S. destroyers and cruisers. An additional LCSRON-2 LCS is scheduled to deploy early in FY 2020. Vice Admiral Brown also stated that these deployments will commence LCS persistent deployed forward presence as planned under the 2016 LCS operational plan.⁹⁰

The FY 2019 NDAA included funding for three LCSs, two more than the Navy's FY 2019 budget request and three more than the Navy's 2016 FSA requirement of 32 ships. The Navy has not included any LCSs in its FY 2020 budget request because it will be awarding the initial FFG(X) contract in FY 2020. The Navy projects that the LCS battle force will reach 20 LCSs by the end of FY 2019 and 22 by the end of FY 2020.⁹¹ Even when combined with the 11 remaining mine countermeasure vessels in the fleet, this is still well below the fleet size of 71 small surface combatants needed to fulfill the Navy's global responsibilities.

In July 2017, the Navy released a Request for Information (RFI) to the shipbuilding industry with the goal of building a new class of 20 ships, currently referred to as the future guided missile frigate (FFG(X)), beginning in FY 2010.⁹² The Navy stated that:

The purpose of this type of ship is to (1) fully support Combatant and Fleet Commanders during conflict by supplementing the fleet's undersea and surface warfare capabilities, allow for independent operations in a contested environment,

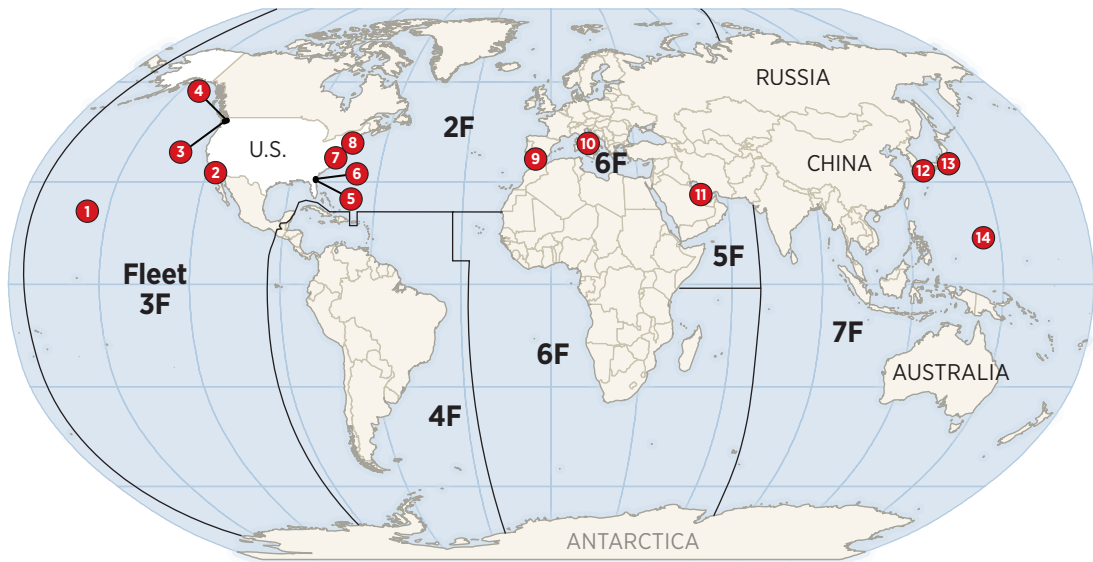
extend the fleet tactical grid, and host and control unmanned systems; and (2) relieve large surface combatants from stressing routine duties during operations other than war.⁹³

The RFI further specified that:

- “[T]he FFG(X) will normally aggregate into strike groups and Large Surface Combatant led surface action groups but also possess the ability to robustly defend itself during conduct of independent operations while connected and contributing to the fleet tactical grid”;
- “Complement the surface warfare (SuW) capabilities of a Carrier Strike Group and Expeditionary Strike Group with capacity in aggregated operations (e.g., as a pack) to deter or defeat aggression by adversary warships with over-the-horizon anti-ship missiles”;
- “Perform anti-submarine warfare (ASW) scout and patrol missions that complement the capabilities of Strike Group and theater operations with enhanced active and passive undersea sensing capabilities”; and
- “Support transoceanic logistics movements by serving as a force multiplier to area air defense capable destroyers.”⁹⁴

The Navy's FY 2020 shipbuilding plan would procure the 20 frigates between FY 2020 and FY 2030. The Navy's desire to award the FFG(X) detailed design and construction contract in FY 2020 did not provide sufficient time for a completely new design, instead driving it to build FFG(X) based on an existing SSC ship design that can be modified to meet the FFG(X)'s specific capability requirements.⁹⁵ On February 16, 2018, the Navy awarded five FFG(X) conceptual design contracts to Austal USA; Huntington Ingalls Industry/Ingalls Shipbuilding (HII/Ingalls); Lockheed Martin;

Key U.S. Naval Installations



1 Joint Base Pearl Harbor-Hickham, Hawaii
U.S. Pacific Fleet headquarters; homeport to CGs, DDGs, and SSNs

2 Naval Base San Diego and Naval Base Coronado, Calif.
U.S. Third Fleet headquarters; largest West Coast U.S. naval base; homeport to CVNs, CGs, DDGs, LCSs, SSNs, and amphibious ships

3 and 4 Naval Base Kitsap and Naval Station Everett, Wash.
Homeport to CVNs, SSNs, DDGs, and U.S. Pacific Fleet SSBNs and SSGNs

5 Naval Station Mayport, Fla.
U.S. Fourth Fleet headquarters; homeport to CGs, DDGs, amphibious ships, and LCSs

6 Naval Submarine Base King's Bay, Ga.
Homeport to U.S. Fleet Forces Command SSBNs, and SSGNs

7 Naval Base Norfolk and Joint Expeditionary Base Little Creek, Va.
U.S. Fleet Forces Command and U.S. Second Fleet headquarters; largest naval base in the world; homeport to CVNs, CGs, DDGs, amphibious ships, and SSNs

8 Naval Submarine Base Groton, Conn.
Homeport to SSNs

9 Naval Station Rota, Spain
Homeport to ballistic missile defense DDGs

10 Naval Support Activity Gaeta, Italy
U.S. Sixth Fleet headquarters; homeport to U.S. Sixth Fleet command ship

11 Naval Support Activity, Bahrain
U.S. Fifth Fleet headquarters; homeport for MCM ships; provides logistics support for ships forward deployed to U.S. Fifth Fleet

12 U.S. Fleet Activity Sasebo, Japan
Homeport to amphibious ships and MCM ships

13 U.S. Fleet Activity Yokosuka, Japan
Largest overseas U.S. naval base; U.S. Seventh Fleet headquarters; homeport to CVN, CGs, DDGs, and U.S. Seventh Fleet command ship; provides logistics support for ships forward deployed to U.S. Seventh Fleet

14 Naval Base Guam: Navy Expeditionary Force Command Pacific headquarters
Homeport to SSNs and submarine tenders; provides logistics support for SSNs forward deployed to U.S. Seventh Fleet

NOTE: Fleet boundaries are approximate.

SOURCE: Heritage Foundation research.

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Fincantieri/Marinette Marine (F/MM); and General Dynamics/Bath Iron Works (GD/BI-W).⁹⁶ The Navy will select one shipbuilder in FY 2020.⁹⁷

As noted earlier, the Navy has been conducting an updated Force Structure Assessment that should be released before the end of 2019. Details are not yet available, but Navy officials have suggested that the proportion of SSCs (frigates) compared to LSCs (destroyers and cruisers) would likely increase as the Navy moves to a more distributed and dispersed CONOPS. A recent OPNAV N96 Surface Warfare directorate brief provides a glimpse into a future distributed surface force architecture with twice as many SSCs as LSCs.⁹⁸ If the Navy does pursue a much larger SSC force, it could expand the FFG(X) requirement and increase the build rate above two per year so that it can meet a new force goal more rapidly.

As of August 20, 2019, the Navy possessed 22 *Ticonderoga*-class (CG 47) cruisers.⁹⁹ To save operating expenses, it has been pursuing a plan to put half of this fleet into temporary layup status in order to extend this class's fleet service time into the 2030s—even though these ships are younger than their expected service lives (in other words, have been used less than planned). Under the FY 2015 National Defense Authorization Act:

Congress...directed the Navy to implement the so-called “2-4-6” program for modernizing the 11 youngest Aegis cruisers. Under the 2-4-6 program, no more than two of the cruisers are to enter the modernization program each year, none of the cruisers is to remain in reduced status for modernization for more than four years, and no more than six of the cruisers are to be in the program at any given time....¹⁰⁰

The Navy's FY 2020 budget request removed funding for SLEs for the six oldest cruisers, added in the FY 2019 request, in exchange for increased readiness and lethality investments.¹⁰¹ The retirement of the two

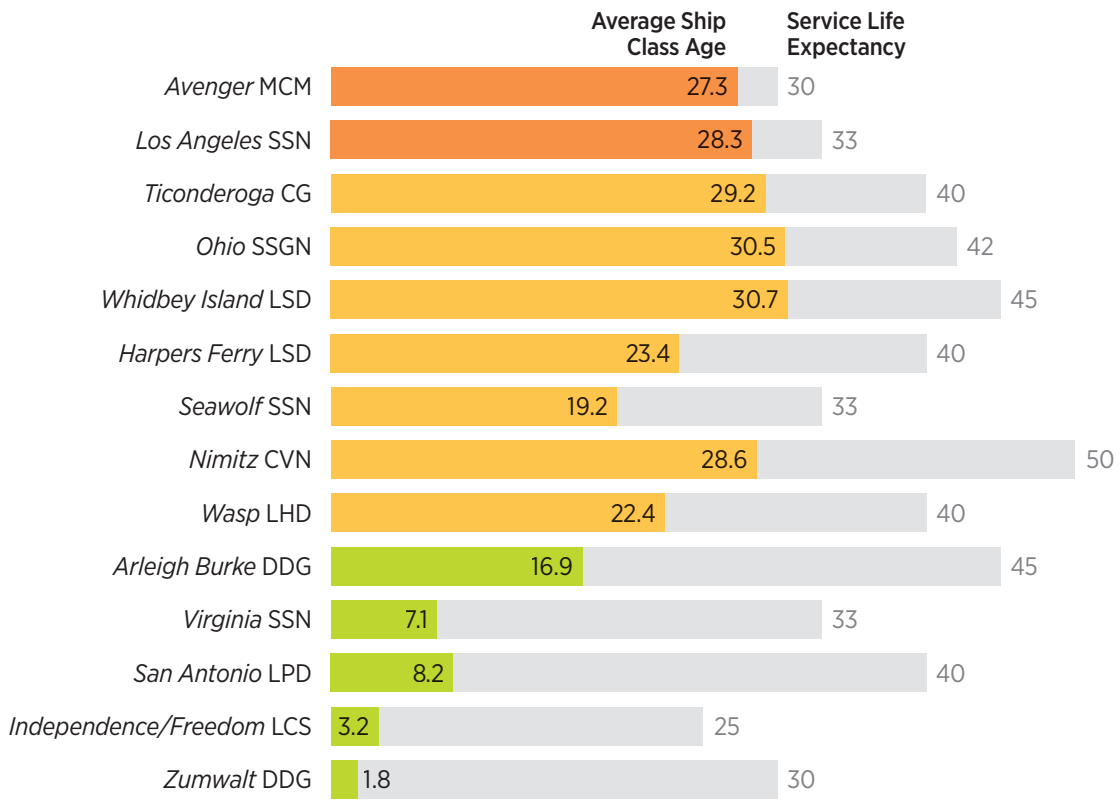
oldest cruisers, scheduled for FY 2020, has been deferred to FY 2021 so that the Navy can assess the cost versus increased lethality from modernizing these ships. The Navy will continue to execute the “2-4-6” plan in FY 2020. This “CG Modernization (Mod) Program...upgrades combat systems; command, control, communications, computers, and intelligence (C4I) systems; and hull, mechanical, and electrical (HM&E) systems to achieve an extended service life and pace the multi-mission threats.”¹⁰² The Navy's FY 2020 budget request supports the continued modernization of the nine newest *Ticonderoga*-class cruisers (CG 65–CG 73).¹⁰³

The Navy's FY 2020 budget request procures three DDG 51 Flight III destroyers as part of a 10-ship multi-year procurement, bringing the class size to 85 ships.¹⁰⁴ The Flight III provides a significant capability upgrade to the Navy's integrated air and missile defense with the incorporation of the air and missile defense radar. In addition, “PB-20 includes \$4 billion across the FYDP to modernize 19 guided missile destroyers. This includes critical upgrades to AEGIS Baseline 9, enabling them to simultaneously perform Integrated Air and Missile Defense (IAMD) and Ballistic Missile Defense (BMD) operations.”¹⁰⁵

The DDG-1000 *Zumwalt*-class “is a multi-mission destroyer with an originally intended emphasis on naval surface fire support (NSFS) and operations in littoral (i.e., near-shore) waters.”¹⁰⁶ The *Zumwalt*-class has been plagued by cost overruns, schedule delays, and the exorbitant cost of the projectile for its advanced gun system. In July 2008, the Navy announced that it would end procurement of DDG-1000s after the initial three ships because it had “reevaluated the future operating environment and determined that its destroyer program must emphasize three missions: open-ocean antisubmarine warfare (ASW), countering anti-ship cruise missiles (ASCMs), and countering ballistic missiles.”¹⁰⁷ The stealthy DDG-1000 hull design cannot support the required ballistic missile defense capabilities without significant modifications.

Combat Fleets Pushing Limits of Life Expectancy

AVERAGE SHIP CLASS AGE AS PERCENTAGE OF SERVICE LIFE EXPECTANCY: ■ <50% ■ 50%-75% ■ 75%+



NOTE: Average ship class age as of October 2019.
SOURCE: Heritage Foundation research based on data from U.S. Department of the Navy, U.S. Department of Defense, U.S. Government Publishing Office, and other sources. 📄 [heritage.org](https://www.heritage.org)

A core part of the *Zumwalt*-class’s original NSFS mission was its “two new-design 155mm guns called Advanced Gun Systems (AGS),” which “were to fire a new 155mm, gun-launched, rocket-assisted guided projectile called the Long-Range Land-Attack Projectile (LRLAP, pronounced LUR-lap).” When the DDG-1000 program was cut to three ships, the LRLAP’s cost per round skyrocketed to \$800,000, making the projectile’s cost prohibitive. The Navy has yet to announce a replacement projectile, and the AGSs are currently

non-operational as any replacement munition will require modifications to the AGS and its munition handling equipment.¹⁰⁸

In December 2017, the Navy announced that because of changes in global security threats and resulting shifts in Navy mission requirements since the original DDG-1000’s missions were established in 1995, it was updating the DDG-1000’s primary mission to reflect the current needs of the Navy and the ship’s stealth and other advanced capabilities. The DDG-1000’s primary mission will shift

from an emphasis on naval gunfire support for Marines on shore to an emphasis on surface strike (the use of missiles to attack surface ships and possibly land targets).¹⁰⁹ This offensive strike conversion will incorporate integration of Raytheon's multi-mission SM-6 anti-air and anti-surface missile, as well as the Maritime Strike variant of the Tomahawk missile.¹¹⁰ The Government Accountability Office (GAO) reports that "[a]ccording to Navy officials, the planned modifications to support the new mission will cost about \$1 billion...."¹¹¹

With DDG-1000 still undergoing testing and certification, and given the need to determine the final concept of operations and capabilities required for the offensive strike mission, it will be several years before DDG-1000 is truly mission capable. With a class of only three ships, it will be difficult to maintain even one destroyer forward deployed at all times.

As part of his May 2019 announcement of the establishment of Surface Development Squadron One (SURFDEVRON 1), Vice Admiral Brown discussed a primary near-term role for the *Zumwalt* class. Initially, SURFDEVRON will focus on experimenting with the *Zumwalt*'s unique capabilities and new warfighting concepts. After the Navy's new medium unmanned surface vessels (MUSVs) and large unmanned surface vessels (LUSVs) are delivered, the focus of experimentation will shift to integrating these unmanned vessels into the fleet.¹¹²

In March 2019, Marine Corps Commandant General David Berger, then serving as Deputy Commandant, Combat Development and Integration, and Commanding General, Marine Corps Development Command, reiterated the requirement for 38 amphibious warships: 12 amphibious assault ships (LHA/LHD); 13 amphibious transport dock (LPD-17) Flight I ships; and 13 dock landing (LSD/LPD-17) Flight II ships.¹¹³ As of August 20, 2019, the U.S. Navy amphibious force consisted of 32 ships: nine LHA/LHD, 11 LPD-17 Flight I, and 12 LSD ships.¹¹⁴ Navy leaders have also stated that "the future amphibious force and composition will be evaluated as part of the larger ongoing force

structure assessment."¹¹⁵ New Marine Corps operational concepts, such as Littoral Operations in a Contested Environment and Expeditionary Advanced Base Operations (EABO), call for smaller and more dispersed Marine units conducting missions ranging from ISR to coastal defense to forward arming and refueling points (FARPs) for F-35B operations.¹¹⁶ These dispersed expeditionary operations could require larger numbers of smaller amphibious ships than the current LHA and LPD programs, possibly ranging in size from an expeditionary fast transport ship (T-EPF) to an expeditionary sea base (ESB).¹¹⁷

The Navy's 12 landing ships, the *Whidbey Island*-class and *Harpers Ferry*-class amphibious vessels, are currently scheduled to reach the end of their 40-year service lives in 2025. The 13-ship LPD-17 Flight II program, previously known as the LX(R) program, will replace these legacy landing ships. The Flight II was designed to be a less costly and subsequently less capable alternative to the LPD-17 Flight I *San Antonio*-class design.¹¹⁸ Although the first Flight II ship was planned for FY 2020, Congress directed the Navy to accelerate it to FY 2018.¹¹⁹ Both Flight I and Flight II LPDs are multi-mission ships designed to embark, transport, and land elements of a Marine landing force by means of helicopters, tilt-rotor aircraft, landing craft, and amphibious vehicles.¹²⁰

As of August 20, 2019, the Navy had nine amphibious assault ships in the fleet: eight *Wasp*-class LHDs and the *USS America* LHA-6.¹²¹ The *America*-class amphibious assault ships (LHAs) are the largest amphibious ships and designed to replace the now-retired *Tarawa*-class LHA and the aging *Wasp*-class LHD; they resemble a small aircraft carrier and can conduct "Vertical/Short Take-Off and Landing (V/STOL), Short Take-Off Vertical Landing (STOVL), Vertical Take-Off and Landing (VTOL) tilt-rotor and Rotary Wing (RW) aircraft operations."¹²² LHA Flight 0 (LHA-6 and 7) were built without a well deck to provide more space for Marine Corps aviation maintenance and storage as well as increased JP-5 fuel capacity. LHA Flight 1 (LHA-8 and beyond) will reincorporate a well

deck for increased mission flexibility. All LHA ships can accommodate the Marine Corps F-35 B V/STOL strike fighter, but only USS *Wasp* (LHD-1) and USS *Essex* (LHD-2) have been modified to support F-35B flight operations.¹²³ USS *America* is deploying to Japan in late FY 2019 to replace USS *Wasp* as the Forward Deployed Naval Force amphibious ship, and USS *Tripoli* (LHA-7) is scheduled to be commissioned and to join the fleet in late FY 2019.¹²⁴

The Navy's 11-ship aircraft carrier force consists of 10 *Nimitz*-class nuclear-powered carriers and one *Ford*-class nuclear-powered carrier. The *Nimitz*-class carriers vary in age from 44 to 10 years and have an average age of 28.4 years. U.S. aircraft carriers have a service life of 50 years, with their most significant modernization occurring during their approximately 44-month midlife RCOH. This major depot maintenance not only refuels the reactor core to operate the remainder of the ship's 50-year service life, but also overhauls, repairs, and modernizes major ship and combat systems. This means that a 30-year-old carrier possesses more modern capabilities than a 20-year old carrier.

The USS *Ford*-class program is further modernizing the carrier force and will replace all of the *Nimitz*-class carriers over the next 40 years. The *Ford*-class incorporates several new technologies that promise to increase aircraft sortie rates, decrease the number of sailors needed to operate the ship, and reduce operating and sustainment costs by approximately \$4 billion over its 50-year life.¹²⁵

Unfortunately, "the development of EMALS [Electromagnetic Aircraft Launch System], AAG [Advanced Arresting gear], AWE [Advanced Weapons Elevator], DBR [Dual Band Radar], and the Integrated Warfare System delayed the ship's first deployment to FY22."¹²⁶ Because of continued reliability issues related to system software, the Navy had accepted only two AWEs as of March 2019.¹²⁷ AWE testing delays and repairs to *Ford*'s main turbine generators caused completion of post-shakedown availability (PSA) to be delayed until October 2019.¹²⁸

On May 29, 2019, Assistant Secretary of the Navy for Research, Development and Acquisition James Geurts announced that while USS *Ford* will complete its PSA in October 2019, only some of its AWEs will be operational when she goes back to sea.¹²⁹ In response to the Navy's statement, Senate Armed Services Committee Chairman Senator James Inhofe told *Breaking Defense* that:

[F]urther delays on the USS Gerald R. Ford advanced weapons elevators are disappointing—and present a dangerous readiness gap. This is a letdown for our fleet and for the taxpayer, and is why the FY20 NDAA includes stronger oversight for the key systems on the Ford, including the elevators and launch system. We need to get it fully operational as soon as possible.¹³⁰

The Navy has not announced any delay in USS *Ford*'s first operational deployment, scheduled for FY 2022.

The sole mission of the Navy's nuclear ballistic missile submarine (SSBN) is strategic nuclear deterrence, for which it carries long-range submarine-launched ballistic missiles. They provide the most survivable leg of America's strategic nuclear deterrent force with 70 percent of the nation's accountable nuclear warheads and its only assured second-strike or retaliatory nuclear strike capability.¹³¹ The Navy's force structure assessment and the DOD's 2018 *Nuclear Posture Review* established a requirement for a minimum of 12 *Columbia*-class nuclear ballistic missile submarines to replace the legacy *Ohio*-class SSBN.¹³² The average acquisition cost of these submarines is \$7.1 billion, and their production will consume a significant portion of the Navy's shipbuilding funding if the overall budget is not increased.¹³³

The Navy's FY 2013 budget deferred procurement of the lead boat from FY 2019 to FY 2021, with the result that the Navy's SSBN force will drop to "11 or 10 boats for the period FY2030–FY2041."¹³⁴ The Navy may have increased difficulty maintaining U.S. Strategic

Command's requirement for a minimum of 10 operational SSBNs as it strives to maintain the legacy *Ohio*-class SSBN fleet to the end of their 42-year service life. With little schedule margin until its first strategic deterrent patrol in FY 2031, it is easy to see why the *Columbia*-class SSBN remains "the Navy's number one acquisition priority."¹³⁵

The *Columbia*-class design incorporates several new technologies to increase its stealth and operational availability. The submarine and its life-of-ship reactor core have been designed for a 42-year service life as opposed to the service life of the *Ohio*-class, which was extended from 30 years to 42 years.¹³⁶ The Navy needs 12 *Columbia*-class SSBNs "to meet the requirement for 10 operational boats because the midlife overhauls of *Columbia*-class boats, which will not include a nuclear refueling, will require less time (about two years) than the midlife refueling overhauls of *Ohio*-class boats...."¹³⁷ Additionally, the submarine's electric drive propulsion motor and other stealth technologies will ensure that the nation's SSBN force remains undetectable and survivable against evolving threats into the 2080s.

Significant defects in key equipment have eroded some of the *Columbia* program's schedule margin. In 2017, "[a] manufacturing defect that affected the system's first production-representative propulsion motor required extensive repair that consumed 9 months of schedule margin at the land-based test facility."¹³⁸ This was followed by the discovery in July 2018 that 12 common missile compartment missile tubes produced by a single vendor had significant welding defects because of inexperienced welders and inspectors.¹³⁹ "While the Navy and shipbuilder are still determining the cost and schedule impacts of the weld defects," according to the GAO, "program officials estimated that addressing this issue will consume up to 15 [months] of the 23-month schedule margin for these components."¹⁴⁰

If additional technical or production issues arise during the construction, *Columbia*'s remaining schedule margin could quickly evaporate. On March 6, 2019, recognizing the critical

importance of the *Columbia* program and its FY 2028 delivery deadline, the U.S. Navy announced "the establishment of Program Executive Office Columbia (PEO CLB)," which "will focus on the design, build, and sustainment of the *Columbia* program and associated efforts that include interface with Strategic Systems Program and the United Kingdom for the Dreadnought Program."¹⁴¹ Assistant Secretary Geurts stated that:

The evolution from initial funding to construction, development and testing to serial production of 12 SSBNs will be crucial to meeting the National Defense Strategy and building the Navy the nation needs. PEO Columbia will work directly with resource sponsors, stakeholders, foreign partners, shipbuilders and suppliers to meet national priorities and deliver and sustain lethal capacity our warfighters need.¹⁴²

SSNs are multi-mission platforms whose primary peacetime and combat missions include covert intelligence collection, surveillance, ASW, anti-surface warfare (ASuW), special operations forces insertion/extraction, land attack strikes, and offensive mine warfare.¹⁴³ The *Virginia*-class SSN will replace the aging *Los Angeles*-class SSNs as the workhorse of the Navy's attack submariner force. The Navy's FY 2020 budget requests three *Virginia*-class SSNs, the first time in over 20 years the Navy has procured three SSNs in one fiscal year.¹⁴⁴ Since the advance procurement for the third *Virginia*-class SSN was not included in the Navy's FY 2019 budget, construction of this third submarine most likely will not commence until FY 2023.¹⁴⁵ Critical parts and equipment for this additional submarine above the planned 10-submarine block buy have not been purchased yet, and the shipyards (Electric Boat and Huntington Ingalls Industries/Newport News Shipbuilding) have not planned for this submarine in their *Virginia*-class construction plan.

The Virginia Payload Module (VPM) is an 84-foot-long, midbody section equipped with

four large-diameter, vertical launch tubes that can carry up to 28 additional Tomahawk missiles or other payloads. VPM is being added to Block V *Virginia*-class submarines to help offset the retirement of the four *Ohio*-class guided missile submarines, each of which can carry 54 Tomahawk cruise missiles, by FY 2028. The Block V submarines also include several acoustic and other technological improvements to maintain the *Virginia* class's undersea superiority over Russian and Chinese submarines.¹⁴⁶

The Navy's FY 2019 shipbuilding plan called for nine of the 10 Block V *Virginia*-class submarines to include VPM. The Navy's FY 2020 budget and shipbuilding plan now call for eight of the now 11 Block V submarines to include VPM.¹⁴⁷ While the Navy's FY 2020 Block V *Virginia*-class submarine construction plan delivers one additional submarine, these 11 submarines will be able to carry 28 fewer Tomahawks than could be carried by the original 10 submarines.

The FY 2020 budget request includes \$806 million to accelerate the Navy's unmanned surface vessel (USV) and unmanned undersea vehicle (UUV) programs. The Navy had planned to pay for the bulk of these unmanned systems in FY 2020 and across the FYDP by canceling the USS *Truman*'s RCOH. With the reversal of this decision, if Congress does not provide additional funding in FY 2020 and beyond, these unmanned programs will be in jeopardy. The Navy is applying a family-of-systems approach to USVs and UUVs that incorporates unmanned platforms of various sizes to perform different missions.¹⁴⁸

The Large USV (LUSV) program will purchase two prototype vessels based on the OSD Strategic Capabilities Office *Overlord* program in FY 2020 to provide distributed lethality and increased capacity.¹⁴⁹ The Navy also issued an RFP for a Medium USV (MUSV) in May 2019 that will leverage the ONR *Sea Hunter* program to provide distributed sensing and communications relays for surface forces. The Navy currently has one *Sea Hunter* prototype, and a second is scheduled for delivery by late FY

2020. The MCM USV is part of the LCS MCM MP and will enter low initial rate production (LRIP) in FY 2019.¹⁵⁰

The Navy is purchasing 37 UUVs in FY 2020, including two *Orca* Extra Large UUVs (XLUUV); 27 Mk-18 *Knifefish* MCM UUVs; and eight *Razorback* medium UUVs. The Navy awarded Boeing a \$43 million contract in February 2019 to build four XLUUVs based on its *Echo Voyager* XLUUV. *Orca* will be pier-launched and long-range (up to 6,500 nm) and will provide a large undersea payload capacity to support a variety of missions.¹⁵¹ *Knifefish* entered LRIP in FY 2019 and is part of the LCS MCM MP providing buried undersea mine detection.¹⁵² *Razorback* provides a submarine-launched and recovered UUV for battlespace sensing. The dry dock shelter-launched version commenced delivery in FY 2019, and the torpedo tube-launched version is scheduled to begin delivery in FY 2020.¹⁵³ The Navy is also developing the *Snakehead* Large Diameter UUV (LDUUV) to provide a submarine or surface ship-launched UUV with increased payload and range. The program will deliver "an operationally relevant prototype in 2021" and issue an RFP for a more capable *Snakehead* UUV in FY 2020.¹⁵⁴

These USV and UUV programs have the potential to provide greater dispersed maritime sensing and lethality, extending the fleet's reach and ISR capabilities. The Navy still has significant testing and CONOPS development to conduct before they become an integral part of the fleet. Getting these prototype platforms in the hands of Navy sailors will accelerate the learning and technological development of unmanned systems.

The Navy's long-range strike capability derives from its ability to launch various missiles and combat aircraft. As a class, naval aircraft are much more expensive and difficult to modernize than missiles are. Until the 1980s, the Navy operated several models of strike aircraft that included the F-14 Tomcat, A-6 Intruder, A-4 Skyhawk, and F/A-18 Hornet. The last of the A-6, A-4, and F-14 aircraft were retired, respectively, in 1997, 2003, and 2006.

Over the past 20 years, this variety has been winnowed to a single model: the F/A-18. The F/A-18A-D Legacy Hornet has served since 1983; it is out of production and currently flown by 13 Marine Corps squadrons, the Naval Aviation Warfighting Development Center, and the Blue Angels. The last Navy legacy Hornet squadron completed its final operational deployment in April 2018.¹⁵⁵ The last operational legacy Hornet squadron transitioned to more capable and modern F/A-18E/F Super Hornets in February 2019.¹⁵⁶

The F/A-18E/F Super Hornet has longer range, greater weapons payload, and more survivability than the F/A-18A-D Legacy Hornet and “will be the numerically predominant aircraft in CVWs into the 2030s.”¹⁵⁷ The Navy’s FY 2020 budget request includes 24 F/A-18E/F Super Hornets and an additional 84 Block III Super Hornets over the next five years in an attempt to mitigate shortfalls in its strike aircraft inventory.¹⁵⁸ In April 2019, Rear Admiral Scott Conn, Director of Air Warfare (OPNAV N98), testified that the Navy’s strike fighter shortfall will reach its lowest point, 51 aircraft, in FY 2020 before decreasing to “single digits by FY ’24.”¹⁵⁹

The EA-18G Growler is the U.S. Navy’s primary electronic attack aircraft and provides tactical jamming and suppression of enemy air defenses. The final EA-18G aircraft was delivered in FY 2018, bringing the total to 160 aircraft and fulfilling “current Navy requirements for Airborne Electronic Attack (AEA) for nine CVWs and five expeditionary squadrons plus one reserve squadron.” The FY 2020 budget continues to fund additional modernization to ensure that the “EA-18G maintains its edge in the electromagnetic spectrum by providing robust sensing and engagement capabilities.”¹⁶⁰

The Navy has been addressing numerous incidents, or physiological episodes (PEs), of dizziness and blackouts by F/A-18 and T-45 aircrews over the past several years. Navy investigators have identified “multiple interrelated causal factors” and have instituted mitigation efforts that include “software modifications, personnel education, and equipment changes.”

The T-45 training aircraft have undergone a significant reduction in PE rate with only 14 events in over 100,000 hours flown since the aircraft returned to operation. Two events are still under investigation, and seven have been attributed to human factors. In addition to correcting the identified engine flow problem, the Navy is “integrating an Automatic Backup Oxygen System (ABOS) to improve oxygen generating system performance overall.”¹⁶¹

Implemented mitigation efforts are also improving F/A-18 PE rates. F/A-18 A-D PE rates have fallen by almost 50 percent, a reduction that is attributed primarily to implementation of AFB (Air Frame Bulletin) 821, which “places life limits on seven ECS high-time components with the purpose of inspecting and replacing components as necessary to improve and baseline system operation.” The F/A-18 Root Cause Corrective Action Team identified “premature component failure as a contributory factor in almost 300 PEs.” All of the identified parts are undergoing redesign, but only two redesigns will be implemented in FY 2019. A final major PE mitigation effort is the Navy’s ongoing development of a new “On Board Oxygen Generating System concentrator designed to replace the existing concentrator currently in the F/A-18 and EA-18 aircraft.”¹⁶²

Even with the Navy’s focus on identifying and correcting the causes of these events, PEs continue to be a significant concern for the naval aviation community and have further reduced the operational availability of the Navy’s strike fighter and electronic attack aircraft.

The F-35C is the Navy’s largest aviation modernization program. This fifth-generation fighter (all F/A-18 variants are considered fourth-generation) has greater stealth capabilities and state-of-the-art electronic systems, allowing it to sense its tactical environment and communicate with multiple other platforms more effectively. The Department of the Navy plans to purchase 273 Navy F-35Cs and 67 Marine Corps F-35Cs.¹⁶³ The F-35 can accomplish a wide spectrum of missions including strike, close air support, counter air, escort, and suppression of enemy air defenses.¹⁶⁴ The

Navy's objective is to "attain a '2+2' mix of two F-35C squadrons and two F/A-18E/F Block III squadrons per CVW by the mid-2030s."¹⁶⁵

The Navy declared initial operational capability (IOC) of the F-35C in February 2019, explaining that:

In order to declare IOC, the first operational squadron must be properly manned, trained and equipped to conduct assigned missions in support of fleet operations. This includes having 10 Block 3F, F-35C aircraft, requisite spare parts, support equipment, tools, technical publications, training programs and a functional Autonomic Logistic Information System (ALIS). Additionally, the ship that supports the first squadron must possess the proper infrastructure, qualifications and certifications.¹⁶⁶

The F-35C IOC was postponed because of F-35 program development delays and the Navy's unique requirement for Block 3F-equipped F-35C aircraft.¹⁶⁷ The Marine Corps' F-35C reached IOC in 2015, and the Air Force declared the F-35A IOC in 2016.¹⁶⁸ The first operational F-35C deployment is scheduled for FY 2021 as part of Carrier Air Wing 2 onboard USS *Carl Vinson*.¹⁶⁹

The E-2D Advanced Hawkeye is the Navy's carrier-based Airborne Early Warning and Battle Management Command and Control aircraft. The E-2D forms the hub of the Naval Integrated Control-Counter Air system and provides critical Theater Air Missile and Missile Defense capabilities.¹⁷⁰ The Navy's FY 2020 budget procures four aircraft with an additional 14 aircraft to be procured over the next three years.¹⁷¹

The MQ-4C *Triton* is a land-based, high-altitude, long-endurance UAV that fills a "vital role for the Joint Forces Maritime Component Commander by delivering persistent and netted maritime ISR and furthers our plan to retire legacy EP-3E aircraft...."¹⁷² The Navy's FY 2020 budget requests two aircraft on the path to achieving IOC in FY 2021 and eventually

delivering five *Triton* orbits.¹⁷³ The Navy requirement is 68 *Triton* aircraft.¹⁷⁴ The planned initial deployment of two *Triton* UAVs to Guam in FY 2018 was delayed following the September 2018 MQ-4C crash-landing as a result of technical issues with the aircraft.¹⁷⁵

The MQ-25 *Stingray* is a carrier-launched UAV with a primary mission as a carrier-based tanker to extend the range of CVW with a secondary mission to provide ISR for CSGs.¹⁷⁶ The FY 2020 budget requests \$671.3 million to procure three system demonstration test article aircraft and initiate assembly of four engineering development model (EDM) aircraft.¹⁷⁷

The National Defense Strategy's focus on the return to great-power competition and building a more lethal force is manifested in the Navy's FY 2020 budget prioritization of "developing and fielding new capabilities in the areas of unmanned vehicles, directed energy [weapons], artificial intelligence, hypersonics, and other advanced weapons technology."¹⁷⁸

The Navy's FY 2020 budget requests 90 Block V Tactical Tomahawk (TACTOM) cruise missiles; 156 Navigation/Communication upgrade kits to improve performance in A2/AD environments; and 20 Maritime Strike Tomahawk (MST) kits. It also purchases 48 Long Range Anti-Ship Missiles (LRASMs) that will provide the "ability to conduct anti-surface warfare (ASuW) operations against near/mid-term high-value surface combatants protected by Integrated Air Defense Systems with long-range Surface-to-Air-Missiles and deny adversaries sanctuary of maneuver."¹⁷⁹ The Navy's FY 2020 Unfunded Priorities List reflects that the LRASM inventory "is below the Total Munitions Requirement" and requests an additional seven LRASM missiles to "achieve industry's maximum production capacity in FY20."¹⁸⁰ The LRASM "is on-track to achieve EOC on the Navy's F/A-18E/F aircraft prior to the schedule objective of the fourth quarter of FY 2019."¹⁸¹

The Navy has been developing prototype high energy laser (HEL) weapons systems for several years and deployed the first operational HEL system, the Laser Weapons System

(LaWS), onboard the Afloat Forward Staging Base ship USS *Ponce* in the Persian Gulf from December 2014 to September 2017.¹⁸² The Navy's FY 2020 budget request includes \$101 million for the Navy Laser Family of Systems (NLFoS) "to provide near-term, ship-based laser weapon capabilities."¹⁸³ The two primary programs in the NLFoS are:

- Solid State Laser Technology Maturation (SSL-TM), an Office of Naval Research program to "develop an advanced 150kW High Energy Laser (HEL) weapon demonstrator that will support future laser development with installation on an LPD17 class ship for at sea testing in FY 2020."¹⁸⁴
- Surface Navy Laser Weapon System (SNLWS), Increment 1, also known as the high-energy laser with integrated optical dazzler and surveillance (HELIOS), a rapid development effort to field an advanced integrated 60kW or greater laser weapon system with the ability to dazzle and destroy ISR UAVs, defeat fast inshore attack craft (FIAC) and provide combat identification and battle damage assessment.¹⁸⁵

In March 2019, Rear Admiral Ron Boxall, Director of Navy Surface Warfare (OPNAV N96), announced that the Navy plans to install a HELIOS weapons system "aboard a West Coast Arleigh Burke-class Flight IIA destroyer" in 2021.¹⁸⁶ The HELIOS system would be a permanent integrated system.¹⁸⁷

Readiness

Admiral William Moran, Vice Chief of Naval Operations, testified before the Senate Armed Services Readiness Subcommittee in February 2018 that:

The readiness of Naval Forces is a function of three components; people, material and time. Buying all the people, ships and aircraft will not produce a ready Navy without the time to maintain hardware and time for our people to train and

operate. Too much time operating and not maintaining degrades our material and equipment readiness. Conversely, too much time for maintenance has a negative impact on meeting planned training and operational schedules, and the corresponding negative impact on the readiness of our Sailors to fight. This is a vicious cycle that Continuing Resolutions and insufficient funding create by disrupting the balance we need to maintain readiness, and our ability to grow capability and capacity.¹⁸⁸

From FY 2009 to FY 2017, the Department of Defense endured eight straight years of Continuing Resolutions (CRs) that averaged 106 days per fiscal year; this was compounded by the 174-day CR in FY 2018. These CRs forced the Navy to operate under reduced spending levels and severely limited its ability to complete required ship and aircraft maintenance and training.¹⁸⁹ FY 2019 marked the first time in over a decade that the DOD and the Navy did not operate under a CR for at least part of the fiscal year. Having a full fiscal year to plan and execute maintenance and operations helped the Navy to continue its path to restoring fleet readiness. Admiral Richardson testified before the Senate Armed Services Committee in April 2018 that it would take until 2021 or 2022 to restore fleet readiness to an "acceptable" level but that the continued lack of "stable and adequate funding" would delay these efforts.¹⁹⁰

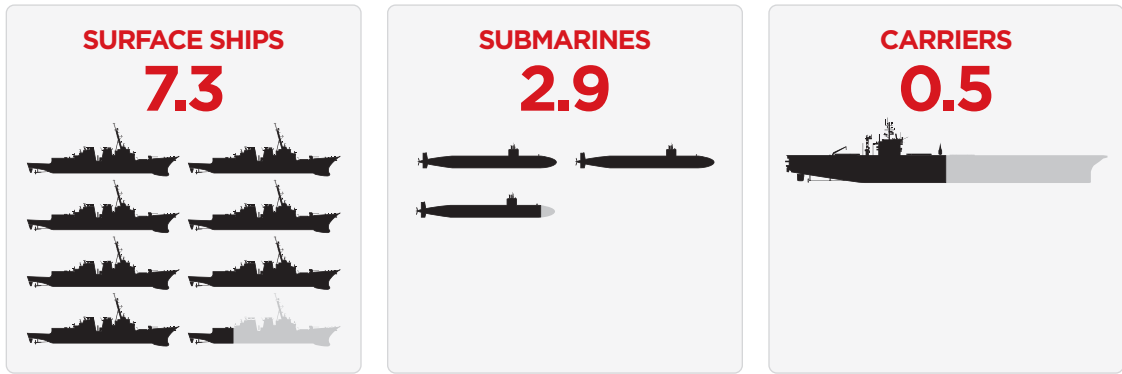
Assessing the readiness of individual naval ships and their sailors can be extremely difficult. First, official readiness data on each Navy ship, submarine, or aircraft squadron are maintained and promulgated via the classified Defense Readiness Reporting Network–Navy. The readiness level of each ship and its crew will also vary significantly over the 36-month OFRP cycle as the ship conducts various maintenance, training, and certifications in preparation for its operational deployment.

Because the demands of material readiness and operational readiness are sometimes in opposition to each other, these two critical

FIGURE 7

Ship Maintenance Delays Limit U.S. Navy

Maintenance delays have led to thousands of days in which ships were unavailable for training and operations, effectively diminishing the size of the Navy. Figures shown below are the average number of ships lost per year for 2012–2018 due to maintenance delays.



SOURCE: Heritage Foundation calculations based on data from U.S. Government Accountability Office, "Navy and Marine Corps: Rebuilding Ship, Submarine, and Aviation Readiness Will Require Time and Sustained Management Attention," December 12, 2018, <https://www.gao.gov/assets/700/695911.pdf> (accessed June 18, 2019). Figures shown are for fiscal years.

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readiness components may not always be in sync. For example, although the operational readiness of a ship's crew just completing a seven-month overseas deployment will be very high, its material readiness could be lower because periodic maintenance and repairs could not be completed during deployment. While determining the readiness of individual ships can be problematic, overall fleet readiness can be assessed based on operational demand and reports on fleet training, maintenance, and fleet manning.

Like the other services, the Navy had to dedicate readiness funding to the immediate needs of various engagements around the globe for several years. As a result, maintenance and training for non-deployed ships and sailors were not prioritized. Deferral of ship and aircraft depot maintenance because funding is inadequate or public shipyards lack sufficient

capacity has had a ripple effect on the whole fleet. When ships and aircraft are finally able to begin depot maintenance, their material condition is worse than normal because of the delay and high operational tempo (OPTEMPO) of the past 15 years. This in turn causes maintenance to take longer than scheduled, which leads to further delays in fleet depot maintenance and increases the demands placed on ships and aircraft that are still operational. Correcting these maintenance backlogs will require a level of stable funding that is sufficient to defray the costs of ship maintenance and modernize the public shipyards.

These maintenance and readiness issues also affect the Navy's capacity by significantly reducing the numbers of operational ships and aircraft available to support the combatant commanders. For example, between 2012 and 2018, ship maintenance delays resulted in the

loss of 1,207 aircraft carrier, 18,581 surface ship, and 7,321 submarine operational days.¹⁹¹ This is the equivalent of losing 0.5 aircraft carriers, 7.3 surface ships, and 2.9 submarines from fleet operations each year. In FY 2018, even with additional readiness funding, maintenance delay days increased for aircraft carriers, surface ships, and submarines.¹⁹² The almost six-month FY 2018 CR also helped to delay the start of new depot maintenance last year. The domino effect of cascading deferred maintenance has led to a \$763 million shortfall in surface ship and submarine depot maintenance funding in FY 2020.¹⁹³

The USS *Boise* has become the poster child for excessive submarine maintenance backlogs. Her certification for submerged operations expired in 2016 when Norfolk Naval Shipyard was unable to commence *Boise's* scheduled depot maintenance for over three years.¹⁹⁴ No longer able to operate at sea, as of May 25, 2019, USS *Boise* has sat pierside for over 1,088 days (almost three years) awaiting commencement of her depot maintenance.

After awarding a contract to Huntington Ingalls/Newport News Shipbuilding (HII/NNS), USS *Boise* was scheduled to begin maintenance in January 2019.¹⁹⁵ Because of continued delays with overhauls of USS *Helena* and USS *Columbus*, however, USS *Boise* remains without an official start date for her maintenance.¹⁹⁶ During a May 9, 2019, readiness hearing, Admiral Moran informed Congress that the Navy had deferred *Boise's* depot maintenance until FY 2020 because of funding and shipyard capacity issues.¹⁹⁷

Funding ship maintenance at the maximum executable capacity of both public and private shipyards in FY 2020 can address only 95 percent of the required maintenance, a decrease from a 96 percent execution in FY 2019.¹⁹⁸ Funding FY 2020 aviation maintenance at the maximum executable level of the depots can meet only 95 percent of the requirement, an increase from FY 2019's 92 percent execution rate.¹⁹⁹

Since the Navy cannot meet its current maintenance demands, the maintenance

backlog will continue to grow until the capacities of the ship and aviation maintenance enterprise exceed the annual maintenance requirements. As the fleet grows to 355 ships over the next 15 years, the mounting maintenance needs will stress not only shipyard repair capacity, but also future Navy budgets. For example, the Navy's fleet sustainment costs (manpower, operations, and maintenance) will rise from approximately \$24 billion in FY 2020 to \$30 billion in FY 2024.²⁰⁰

The FY 2019 NDAA funded increasing the public shipyard workforce by 1,414 workers, and the Navy's FY 2020 budget requests an additional 1,223 workers.²⁰¹ Even with the hiring of additional shipyard workers over the past three years, the public (government-owned) shipyards can still not keep up with ship and submarine maintenance demands. Newly hired shipyard workers do not immediately translate into increased productivity. Since it can take up to five years to become fully trained and proficient, depending on the specific skill set of the new workers, the true impact of the larger shipyard workforce will not be felt for several years.

Recognizing the importance of the Navy's four public shipyards to fleet readiness and national defense, Naval Sea Systems Command (NAVSEA) completed its Shipyard Optimization and Recapitalization Plan in September 2018. This plan lays out the framework and investment plan to modernize the public shipyards through three primary focus areas: dry dock recapitalization (\$4 billion); facility layout and optimization (\$14 billion); and capital equipment modernization (\$3 billion).²⁰² The Navy commenced this \$21 billion, 20-year public shipyard optimization plan in FY 2019.

In response to NDS guidance and "requirements for sustaining the Navy the nation needs," the Navy developed its inaugural Naval Sea System Command Long-Range Plan for the Maintenance and Modernization of Naval Vessels for Fiscal Year 2020. The plan complements the Navy's annual 30-year shipbuilding plan and "describes the Navy's continued challenges with high-tempo operations that

[have] resulted in a maintenance backlog and reduced readiness rates for Navy ships.” It also captures key efforts across private and public shipyards, as well as the industrial base, to improve maintenance capacity and capabilities. Finally, it commits the Navy to the development of “long-range maintenance and modernization requirements based on technical analysis and condition assessment of the fleet driven by the number of ships in the FY 2020 Shipbuilding Plan.”²⁰³

This long-term maintenance and modernization plan will be critical to leveraging both public and private shipyard capacity most efficiently to reduce maintenance backlogs while supporting a growing fleet size. Providing private shipyards with several years to plan depot-level maintenance will enable more thorough maintenance planning and dry dock utilization, ultimately resulting in shorter and more cost-effective maintenance availabilities.

Ship and aircraft operations and training are just as critical to fleet readiness as maintenance is. The Navy’s FY 2020 budget supports the OFRP and forward deployed presence requirements by funding ship operations for deployed and non-deployed forces at a rate of 58 days and 24 days underway per quarter, respectively.²⁰⁴ In addition, flight hours are funded to achieve a T-rating of 2.0 for nine Navy carrier air wings supporting the “requirements of deployed units, units training in preparation to deploy, and the maximum executable requirements of non-deployed units for sustainment and maintenance readiness levels.”²⁰⁵ T-rating is measured on a scale of 1.0–4.0 and “describes a unit’s capability to execute its mission essential tasks (METs).” A T-rating of 2.0 means that a squadron or air wing is “able to complete 80 percent of its METs.”²⁰⁶

The Navy’s aviation readiness is also suffering because of deferred maintenance, delayed modernization, and high OPTEMPO. An April 2018 *Military Times* report revealed that over the past five years, naval aviation mishaps had increased 82 percent across the entire fleet but 108 percent for F/A-18E/F Super Hornets. Although analysis showed numerous causes

behind individual accidents, this abrupt rise began after 2013, the first year that Budget Control Act (BCA) sequestration limits took effect. The Navy made cuts in aviation maintenance and spare parts to meet budget caps while operational demand was simultaneously increasing. For example, F/A-18E/F Super Hornets “conducted 18,000 more flight hours in 2017 than in 2013.”²⁰⁷

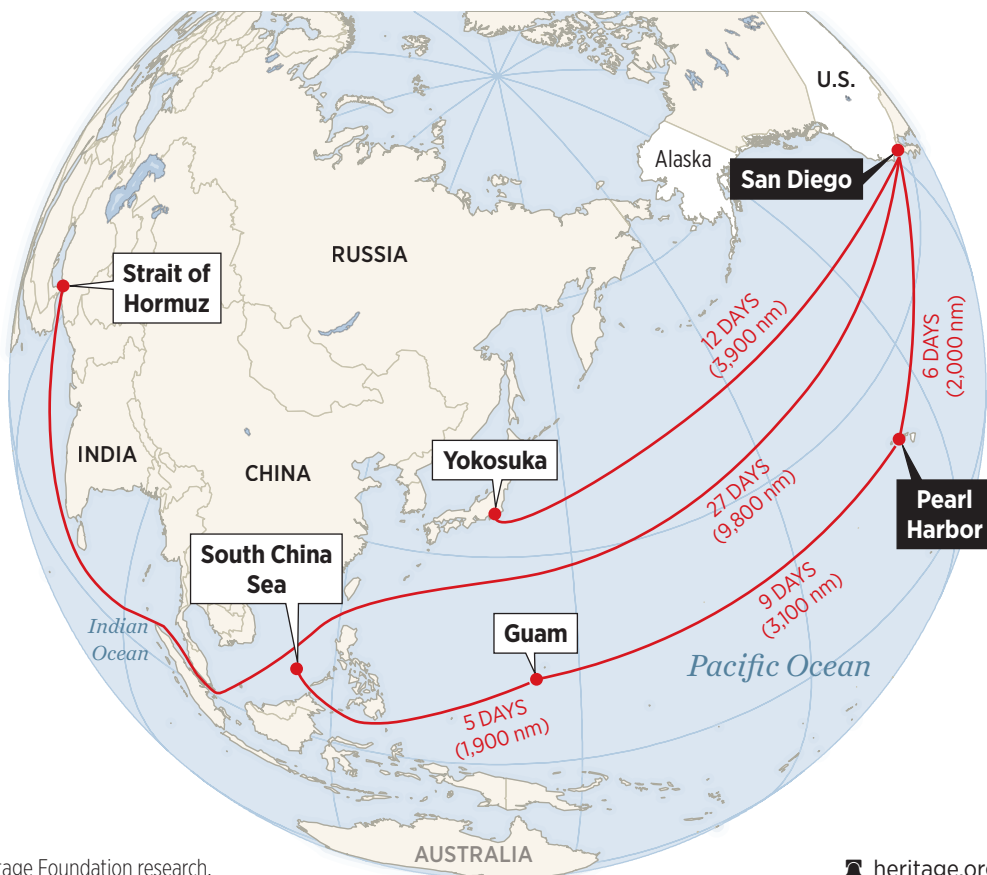
The naval aviation community made extreme efforts to gain every bit of readiness possible with the existing fleet, but even these efforts cannot solve the problems of too little money, too few usable assets, and too much work. Consistent with its policy of “supporting deployed and next to deploy forces,” the Navy was “forced to cannibalize aircraft, parts and people” to ensure that deploying squadrons had sufficient operational aircraft and personnel to operate safely and effectively. Moreover, “to properly man the required Carrier Air Wings either on deployment or on preparing to deploy at mandated levels of 95%, there are not enough Sailors left to fill the two remaining Air Wings in their maintenance phase.”²⁰⁸

On September 17, 2018, then-Secretary of Defense James Mattis issued a memorandum tasking the military service secretaries with “achieving a minimum of 80% mission capability rates for our FY 2019 Navy and Air Force F-35, F-22, F-16, and F-18 inventories—assets that form the backbone of our tactical air power—and reducing these platforms’ operating and maintenance costs every year, starting in FY 2019.”²⁰⁹

A Naval Air Forces spokesman informed USNI News that before the memo’s release, the “latest combined Super Hornet readiness number was 53.3 percent.”²¹⁰ In response to the Mattis memorandum, Navy leadership commenced working with the commercial airline industry to improve the efficiency of F/A-18 aviation maintenance and spare parts logistics.²¹¹ These efforts have led to significant improvements both in the plane’s maintenance efficiency and in its Mission Capable rate. In April 2019, Rear Admiral Conn informed Congress that “we’ve reduced the planned

Steaming Times to Areas of Vital U.S. National Interest

Steam times are based on an average speed of 15 knots.



SOURCE: Heritage Foundation research.

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maintenance interval for Super Hornets from 120 to 60 days” and that the Super Hornet Mission Capable rate has been fluctuating between 63 and 76 percent.²¹² Vice Admiral Mathias Winter, Joint Strike Fighter Program Director, testified that as of April 2019, the F-35C’s Mission Capable rate was 84 percent.²¹³

During the summer of 2017, the U.S. Navy experienced the worst peacetime surface ship collisions in over 41 years when the USS *John S. McCain* (DDG 56) and USS *Fitzgerald* (DDG 62) collided with commercial vessels, claiming the lives of 17 sailors, during two unrelated routine “independent steaming” operations in the western Pacific Ocean. These tragic incidents, coupled with the USS *Antietam* (CG 54) grounding and the USS *Lake Champlain* (CG 57) collision earlier in 2017, raised significant concerns about the readiness and operational proficiency of the U.S. Navy’s surface fleet. Admiral Richardson responded by ordering a “service wide operational pause” to review practices throughout the fleet.²¹⁴ The Department of the Navy conducted two major reviews to examine root causes and recommended corrective actions both for the surface fleet and fleet-wide.

In October 2017, at the direction of the Vice Chief of Naval Operations, Admiral Phil Davidson, then Commander, Fleet Forces Command, completed a *Comprehensive Review of Recent Surface Force Incidents* to determine the improvements or changes needed to make the surface force safer and more effective. Admiral Davidson’s review addressed training and professional development; “operational and mission certification of deployed ships with particular emphasis on ships based in Japan”; “deployed operational employment and risk management”; “material readiness of electronic systems to include navigation equipment, surface search radars, propulsion and steering systems”; and “the practical utility and certification of current navigation and combat systems equipment including sensors, tracking systems, displays and internal communication systems.”²¹⁵ His report recommended 58 actions to correct

deficiencies across the “Doctrine, Organization, Training, Material, Leadership and Education, Personnel, and Facilities (DOTMLPF)” spectrum.²¹⁶

The Secretary of the Navy directed a team of senior civilian executives and former senior military officers to conduct a *Strategic Readiness Review* examining issues of governance, accountability, operations, organizational structure, manning, and training over the past three-plus decades to identify trends and contributing factors that have compromised fleet performance and readiness. The report identifies four broad strategic recommendations that the Navy must address to arrest the erosion of readiness and reverse the “normalization-of-deviation” that led to a gradual degradation of standards:

- “The creation of combat ready forces must take equal footing with meeting the immediate demands of Combatant Commanders.”
- “The Navy must establish realistic limits regarding the number of ready ships and sailors and, short of combat, not acquiesce to emergent requirements with assets that are not fully ready.”
- “The Navy must realign and streamline its command and control structures to tightly align responsibility, authority, and accountability.”
- “Navy leadership at all levels must foster a culture of learning and create the structures and processes that fully embrace this commitment.”²¹⁷

After more than a year of repairs, USS *Fitzgerald* finally left the dry dock at Ingalls Shipbuilding on April 16, 2019. *Fitzgerald* has been out of commission since its June 17, 2017, collision. Although the Navy has not released a projected date for the final completion of all repairs and her return to operations, a NAVSEA official did provide the following statement:

Since the ship's arrival in Pascagoula in January 2018, work has focused on restoring the integrity of the hull and topside structures that were damaged during a collision in 2017....

To restore the impacted spaces to full operations and functionality, various Hull, Mechanical and Electrical (HM&E), Combat System (CS) and Command, Control, Communications, Computers and Intelligence (C5I) repairs are being conducted. These repairs range from partial to complete refurbishment of impacted spaces to replacement of equipment such as the radar and electronic warfare suite. The ship is also receiving HM&E, Combat System and C5I modernization upgrades. Due to the extent and complexity of the restoration, both repair and new construction procedures are being used to accomplish the restoration and modernization efforts.²¹⁸

USS *McCain* left the dry dock in Yokosuka in November 2018 after nine months and was still undergoing pierside repairs to return

her to operation as of May 2019. In addition to repairing damage from her collision, “[t]he ongoing availability also includes completing maintenance work that had previously been deferred....”²¹⁹ The Navy is taking advantage of these extended repair availabilities to conduct additional maintenance and modernization, but the fact that these two warships have been non-operational for almost two years still highlights how complex and time-consuming major repairs to modern warships can be. It is hoped that the Navy can learn from these repairs and develop plans for expedited repairs to battle force ships damaged in any future conflict.

Despite the fact that the Navy has implemented several maintenance and training reforms to improve fleet and aviation readiness, it will take several years of Navy leadership oversight and stable funding to ensure that the Navy's sailors and platforms are ready to compete and win against great-power competitors if called upon to do so. It is also worth noting again that the Navy's own readiness assessments are based on the ability to execute a strategy that assumes a force-sizing construct that is smaller than the one prescribed by this *Index*.

Scoring the U.S. Navy

Capacity Score: Weak

The Navy is unusual relative to the other services in that its capacity requirements must meet two separate objectives. First, during peacetime, the Navy must maintain a global forward presence both to deter potential aggressors from conflict and to assure our allies and maritime partners that the nation remains committed to defending its national security interests and alliances. This enduring peacetime requirement to maintain a sufficient quantity of ships constantly forward deployed around the world is the driving force behind ship force structure requirements: enough ships to ensure that the Navy can provide the necessary global presence.

On the other hand, the Navy also must be able to fight and win wars. In this case, the

expectation is to be able to fight and win two simultaneous or nearly simultaneous MRCs. When thinking about naval combat power in this way, the defining metric is not necessarily a total ship count, but rather the carrier strike groups, amphibious ships, and submarines deemed necessary to win both the naval component of a war and the larger war effort by means of strike missions inland or cutting off the enemy's maritime access to sources of supply. An accurate assessment of Navy capacity takes into account both sets of requirements and scores to the larger requirement.

It should be noted that the scoring in this *Index* includes the Navy's fleet of ballistic missile (SSBN) and fast attack submarines (SSN) to the extent that they contribute to the overall size of the battle fleet and with

TABLE 2

Navy Force Structure Assessment

Ship Type/Class	Current Fleet	2016 Force Structure Assessment	2020 Index Recommendation
Ballistic Missile Submarines	14	12	12
Aircraft Carriers	11	12	13
Large Surface Combatants	89	104	105
Small Surface Combatants	30	52	71
Attack Submarines	50	66	65
Guided Missile Submarines	4	0	0
Amphibious Warships	32	38	45
Combat Logistics Force	29	32	54
Command and Support	31	39	35
Total	290	355	400

SOURCE: U.S. Department of Defense, U.S. Navy, Naval Vessel Register, “Fleet Size,” <http://www.nvr.navy.mil/NVRSHIPS/FLEETSIZE.HTML> (accessed September 11, 2019).

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general comment on the status of their respective modernization programs. Because of their unique characteristics and the missions they perform, their detailed readiness rates and actual use in peacetime and planned use in war are classified. Nevertheless, the various references consulted are fairly consistent, both with respect to the numbers recommended for the overall fleet and with respect to the Navy’s shipbuilding plan.

An SSBN’s sole mission is strategic nuclear deterrence, for which it carries long-range submarine-launched ballistic missiles. They provide the most survivable leg of America’s strategic nuclear deterrent force. In contrast, as noted, SSNs are multi-mission platforms whose primary peacetime and combat missions include covert intelligence collection, surveillance, ASW, ASuW, special operations forces insertion/extraction, land attack strikes, and offensive mine warfare.²²⁰

Two-MRC Requirement. This *Index* uses the fleet size required for the Navy “to meet a

simultaneous or nearly simultaneous two-war or two–major regional contingency (MRC)” as the benchmark against which to measure service capacity. This benchmark consists of the force necessary to “fight and win two MRCs and a 20 percent margin that serves as a strategic reserve.” A strategic reserve is necessary because deployment of 100 percent of the fleet at any one time is extremely improbable and risky. Enduring requirements like training and maintenance make such deployment of the entire fleet infeasible, and committing 100 percent of the battle force would leave the nation without any resources available to handle emergent crises.

The primary elements of naval combat power during an MRC operation derive from carrier strike groups (which include squadrons of strike and electronic warfare aircraft as well as support ships) and amphibious assault capacity. Since the Navy maintains a constantly deployed global peacetime presence, many of its fleet requirements are beyond the scope of

the two-MRC construct, but it is nevertheless important to observe the historical context of naval deployments during a major theater war.

Thirteen Carrier Strike Groups. The goal for the Navy's aircraft carrier fleet is derived from analysis of the Joint Force wartime planning scenarios and meets the GFMAP goal for continuous 2.0 CSG forward presence and 3.0 CSG 30-day surge deployment capacity. The U.S. Navy has deployed an average of six aircraft carriers to support major U.S. military operations since the end of the Cold War; key examples include combat operations in Kuwait in 1991, Afghanistan in 2001, and Iraq in 2003.²²¹ As summarized by the Congressional Budget Office:

Maintaining a fleet of 11 carriers would usually allow 5 of them to be available within 30 days for a crisis or conflict (the rest would be undergoing scheduled maintenance or taking part in training exercises and would be unready for combat). Within 90 days, the Navy would generally have seven carriers available. A larger carrier force would be able to provide more ships for a conflict, and a smaller force fewer.²²²

This correlates with the recommendations of numerous force-sizing assessments, from the 1993 Bottom-Up Review (BUR)²²³ to the Navy's 2016 Force Structure Assessment,²²⁴ each of which recommended at least 11 aircraft carriers.

Assuming that 11 aircraft carriers are required to engage simultaneously in two MRCs, and assuming that the Navy ideally should have a 20 percent strategic reserve in order to avoid having to commit 100 percent of its CSGs and to account for scheduled maintenance, the Navy should maintain 13 CSGs. Several Navy-specific metrics regarding fleet readiness and deployment cycles support a minimum of at least a 20 percent capacity margin above fleet operational requirements.²²⁵

The November 2017 Chief of Naval Operations Instruction 3501.316C, "Force

Composition of Afloat Navy and Naval Groups," provides the most current guidance on CSG baseline capabilities and force mix:

- Five to seven air and missile defense-capable large surface combatant ships (guided missile cruiser (CG) or guided missile destroyer (DDG)) to conduct anti-ship missile and anti-air warfare defense;
- A naval integrated fire control, counter air-capable cruiser as the preferred ship for the air and missile defense commander;
- No fewer than three cruise missile land attack-capable (such as Tomahawk land attack missile or follow-on weapon) large surface combatant ships;
- No fewer than three surface warfare cruise missile-capable (such as Harpoon or follow-on weapon) large surface combatant ships;
- No fewer than four multi-functional tactical towed array systems; and
- One fast combat support (T-AOE) or equivalent pair of dry cargo and ammunition (T-AKE) and fleet replenishment oiler (T-AO) combat logistics force ships.²²⁶

Although not mentioned in this instruction, historically, at least one SSN was typically assigned to a CSG during the Cold War.²²⁷

Based on these requirements and the capabilities of current and planned ship classes, the nominal CSG force composition to possess the capacity needed to support a major regional conflict is:

- One nuclear-powered aircraft carrier;
- One carrier air wing (CVW);
- One guided missile cruiser;
- Four guided missile destroyers;

- Two guided missile frigates;
- Two nuclear-powered attack submarines;
- One fast combat support ship or pair of one dry cargo and ammunition and one fleet replenishment oiler; and
- Until the Navy's new FFG(X) becomes operational, a nominal CSG that consists of six instead of four DDGs.

Thirteen Carrier Air Wings. In the above-referenced examples,²²⁸ each carrier deployed for combat operations was equipped with a carrier air wing, making five to six air wings necessary for each of the major contingencies listed. The strategic documents differ slightly in this regard because each document suggests that one less carrier air wing than the number of aircraft carriers is sufficient.

A carrier air wing customarily includes four strike fighter squadrons.²²⁹ Twelve aircraft typically comprise one Navy strike fighter squadron, so at least 48 strike fighter aircraft are required for each carrier air wing. To support 13 carrier air wings, the Navy therefore needs a minimum of 624 strike fighter aircraft.²³⁰

Fifteen Expeditionary Strike Groups. The 1993 BUR recommended a fleet of 41 large amphibious vessels to support the operations of 2.5 Marine Expeditionary Brigades (MEBs).²³¹ Since then, the Marine Corps has expressed a need to be able to perform two MEB-level operations simultaneously, which would require a fleet of 38 amphibious vessels.²³²

The number of amphibious vessels required in combat operations has declined since the Korean War, which employed 34 amphibious vessels. For example, 26 were deployed in Vietnam; 21 were deployed for the Persian Gulf War; and only seven supported Operation Iraqi Freedom, which did not require as large a sea-based expeditionary force.²³³ The Persian Gulf War is the most pertinent example for today because it was a two-MEB operation, the capabilities of this 1991 amphibious force are similar to present-day amphibious ships, and

the modern requirements for an MEB most closely resemble this engagement.²³⁴

The Marine Corps describes an MEB Amphibious Assault Task Force (AATF) as consisting of five amphibious transport dock ships (LPDs); five dock landing ships (LSDs); and five amphibious assault ships, either landing ship assault (LHA) or landing helicopter dock (LHD).²³⁵ In conjunction with the Navy's Expeditionary Strike Group definition, five ESGs compose one MEB AATF.²³⁶ The Navy also specifies that for an ESG, "other forces assigned" such as "surface combatants and auxiliary support vessels will be similar to those assigned to a CSG dependent on the threat and capabilities of the ships assigned."²³⁷

Based on these requirements and definitions, the nominal ESG engaged in an MRC would include:

- One landing ship assault or landing helicopter dock,
- One amphibious transport dock,
- One amphibious dock landing ship,
- Two guided missile destroyers,
- Two guided missile frigates, and
- One fast combat support ship or pair consisting of one dry cargo and ammunition and one fleet replenishment oiler.

Two simultaneous MEB-level operations therefore require a minimum of 10 ESGs or 30 operational amphibious warships. The 1996 and 2001 QDRs each recommended 12 amphibious ready groups. While the Marine Corps has consistently advocated a fleet of 38 amphibious vessels to execute its two-MEB strategy,²³⁸ it is more prudent to field a fleet of at least 45 amphibious ships. This incorporates a more conservative assumption that 12 ESGs could be required in a two-MRC scenario against near-peer adversaries in addition to ensuring a strategic reserve of 20 percent.²³⁹

Total Ship Requirement. This *Index* assesses that a minimum of 400 U.S. Navy battle force ships is required to provide:

- The 13 carrier strike groups and 15 expeditionary strike groups required to meet the simultaneous two-MRC construct;
- The historical steady-state demand of approximately 100 ships constantly forward deployed in key regions around the world; and
- Sufficient capacity to maintain the Navy's ships properly and ensure that its sailors are adequately trained to "fight tonight."

The bulk of the Navy's battle force ships are not directly supporting a CSG or ESG during peacetime operations. Many surface vessels and attack submarines deploy independently, which is often why their requirements exceed those of a CSG. The same can be said of the ballistic missile submarine (nuclear missiles) and guided missile submarine (conventional cruise missiles), which operate independently of an aircraft carrier.

This *Index*'s benchmark of 400 battle force ships is informed by previous naval force structure assessments and government reports as well as independent analysis incorporating the simultaneous two-MRC requirement, CSG and ESG composition, and other naval missions and requirements. Because they have not yet matured sufficiently to replace manned ships or submarines in the battle force, unmanned systems are not included in the recommended fleet composition. Ship classes that are not current programs of record also were not included in this assessment because notional ship designs do not have validated requirements, their capabilities are unknown, and they have no assurance of being built.²⁴⁰

The most significant differences between this updated total ship requirement and the Navy's 2016 FSA are in SSC and CLF ships. The increase in SSCs from the Navy requirement of 52 to 71 is driven primarily by the

assessed CSG and ESG compositions, which include two FFGs per strike group. The two-MRC ESG and CSG demand alone requires 56 FFGs in addition to the continued requirement for a combination of at least 15 MCM ships and MIW LCSs. Similarly, the CLF requirement of 54 ships is dependent on the logistics demands of the two-MRC requirement of 13 operational CSGs and 12 ESGs. Since the Navy possesses only two T-AOEs that can each support the fuel and ammunition needs of a strike group, a pair of single-purpose T-AOs and T-AKEs is required for each CSG and ESG.

While a 400-ship fleet is significantly larger than the Navy's current 355-ship requirement, it should be noted that the final 2016 FSA requirement of 355 ships was based on the previous Administration's "Defeat/Deny" Defense Planning Guidance and "delivers future steady state and warfighting requirements with an acceptable degree of risk."²⁴¹ The Navy's analysis determined that a 459-ship force was "needed to achieve the Navy's mission with reasonable expectations of success without incurring significant losses" but that it was "unreasonable... to assume we would have the resources to aspire to a force of this size with this mix of ships."²⁴² Finally, this FSA has not been updated to address the 2018 National Defense Strategy, which reestablished "[l]ong-term strategic competitions with China and Russia" as the DOD's "principal priorities."²⁴³

The numerical values used in the score column refer to the five-grade scale explained earlier in this section, where 1 is "very weak" and 5 is "very strong." Taking the *Index* requirement for Navy ships as the benchmark, the Navy's current battle forces fleet capacity of 289 ships, planned fleet of 296 ships by the end of FY 2019, and revised fleet size (implied by both the 2018 NDS, which highlights great-power competition, and analysis of the Navy's history of employment in major conflicts) result in a score of "weak," which is unchanged from the 2019 *Index*. Depending on the Navy's ability to fund more aggressive growth options and SLEs as identified in the FY 2020 30-year shipbuilding plan; the *Columbia*-class ballistic missile

submarine and *Ford*-class aircraft carrier programs that will consume a significant portion of the current shipbuilding budget per hull; and the growing number of ship and submarine retirements, the Navy's capacity score could fall further in the "weak" category in the near future.

Capability Score: Marginal

The Navy's overall capability score remained "marginal." This was consistent across all four components of the capability score: "Age of Equipment," "Capability of Equipment," "Size of Modernization Program," and "Health of Modernization Programs." Given the number of programs, ship classes, and types of aircraft involved, the details that informed the capability assessment are presented more accessibly in a tabular format as shown in the Appendix.

Readiness Score: Marginal

The Navy's readiness score also remained "marginal." This assessment combines two major elements of naval readiness: the ability to provide both the required levels of presence around the globe and surge capacity on a consistent basis. As elaborated below, the Navy's ability to maintain required presence in key regions is "strong," but its ability to surge to meet combat requirements ranges from "weak" to "very weak" depending on how one defines the requirement. In both cases—presence and surge—the Navy has sacrificed long-term readiness to meet current operational demands for many years.

Although the Navy has prioritized restoring readiness through increased maintenance and training since 2017, as Admiral Richardson has stated, it will take at least until 2022 for the Navy to restore its readiness to required levels.²⁴⁴ To improve personnel readiness:

The FY 2020 Military Personnel, Navy budget request is 5,100 higher than the end strength in FY 2019 and supports Navy manpower, personnel, training, and education. To ensure success, the Navy

has made investments in special and incentive pays, critical to recruiting and retaining the very best people our nation has to offer.

Furthermore, the FY 2020 request increases funding and strength for phased increases in manpower for expeditionary and aviation operational units, re-establishment of U.S. Second Fleet, production recruiters to support increased accession mission capacity, DDG-51 *Arleigh Burke* class destroyer new construction crews and class manpower increases, helicopter maritime strike (MH-60R Seahawk) squadron new construction and manpower requirements, changes to CVN 79 *Gerald R. Ford* class aircraft carrier new construction crew resulting from updated crew phasing, increases to expeditionary mine countermeasures mission, and the necessary capabilities required for increased enlisted and officer accession capacity of 42,000 and 4,500 respectively.²⁴⁵

Although the Navy is working proactively to address manning shortfalls and anticipate the demands of a growing fleet, there are some challenges. In February 2019, Admiral Christopher Grady, Commander, United States Fleet Forces Command, informed Congress that the Navy is short about 6,200 sailors to meet at-sea manning requirements.²⁴⁶ After insufficient crew manning was found to be a contributing factor in the *Fitzgerald* and *McCain* fatal collisions, the Navy reassessed and increased the required number of sailors on all ship classes. The increase in ship crew size from 4 percent to 14 percent across the fleet contributed to this manning shortfall. The average crew size of an *Arleigh Burke*-class destroyer has grown from 240 sailors in 2017 to 272 sailors in 2019 on the path to reaching the new requirement of 318 sailors in FY 2023.²⁴⁷

The Navy barely exceeded its FY 2018 recruiting goal of 39,000 new sailors by only 18 recruits.²⁴⁸ The Navy has assessed that its total manpower will need to grow by approximately

35,000 sailors to support a 355-ship Navy. The Navy faces several challenges in meeting the growing fleet demand for sailors: A strong U.S. economy increases the competition to hire young adults; only approximately 29 percent of young adults qualify to join the military; and only 7 percent of young Americans are interested in enlisting in the Navy.

The Navy is taking proactive approaches to meet these challenges head on by increasing the number of recruiters; focusing 70 percent of its recruiting campaigns on digital platforms; reassessing some outdated recruiting policies; and offering targeted recruitment bonuses for critical Navy occupations such as nuclear power specialties, SEALs, and explosive ordnance disposal technicians.²⁴⁹ These efforts should have a positive impact on the recruitment and retention of sailors, and Navy leadership must continue to prioritize and fund these initiatives not only to recruit, but also to retain more sailors as the fleet grows.

Though the Navy has been able to maintain approximately a third of its fleet globally deployed, and while the OFRP has improved readiness for individual hulls by restricting deployment increases, demand still exceeds the supply of ready ships needed to meet the operational demand of CCDRs sustainably. Admiral Moran expressed deep concern about the Navy's ability to meet the nation's needs in a time of conflict in this exchange with Senator Joni Ernst (R-IA) in 2016:

Senator Ernst: ...If our Navy had to answer to two or more of the so-called four-plus-one threats today, could we do that?

Admiral Moran: ...[W]e are at a point right now...that our ability to surge beyond our current force that's forward is very limited, which should give you a pretty good indication that it would be challenging to meet the current guidance to defeat and deny in two conflicts.²⁵⁰

Three surface ship collisions and one grounding that resulted in the loss of 17 sailors

in the Pacific during 2017 revealed how significant the Navy's and specifically its surface fleet's readiness crisis had become. The Chief of Naval Operations, Admiral Richardson, responded with a directive that "an operational pause be taken in all fleets around the world and that a comprehensive review be launched that examines the training and certification of forward-deployed forces as well as a wide span of factors that may have contributed to the recent costly incidents."²⁵¹

The GAO also conducted its own readiness reviews. One of its most disturbing findings was a lack of formal dedicated training and deployment certification time for the Japan-based ships compared to the CONUS-based ships whose OFRP cycle ensures that all ships are properly trained and mission certified before being forward deployed. Since the Japan-based ships are in a permanently deployed status, and in an effort to meet the ever-increasing demand, these ships were not provided any dedicated training time, and by June 2017, 37 percent of their warfare certifications were expired. Pacific Fleet leadership had increasingly waived these expired certifications to deploy these ships, and the GAO discovered that these waivers increased fivefold between 2015 and 2017.²⁵²

Another critical finding was the lack of basic seamanship proficiency, not just among the crews of USS *John S. McCain* and USS *Fitzgerald*, but across the surface warfare community. Surface Warfare Officer School seamanship competency checks of 196 first sea tour Officer of the Deck-qualified junior officers during the spring of 2018 revealed that evaluations of almost 84 percent of these officers revealed "some concerns" or "significant concerns."²⁵³

The readiness reviews recommended several corrective actions to improve the material condition of Navy ships as well as the professional training and operational proficiency of their crews. For example:

- Cancellation of all risk-assessment mitigation plans (RAMPs) and waivers for expired mission certifications.²⁵⁴

- A new 24-month force generation plan for all Japan-based ships that includes 18 weeks of dedicated training time and seven months of maintenance time.²⁵⁵
- Ready for Sea Assessments on Japan-based “cruisers and destroyers, with the exception of those completing or in maintenance, in order to re-baseline existing afloat certifications.”²⁵⁶
- A redesigned Surface Warfare Officer (SWO) career path that increases professional and seamanship training, adds individual proficiency assessments, and increases at-sea time.²⁵⁷

In January 2018, Under Secretary of the Navy Thomas Modly established a Readiness Reform and Oversight Council (RROC) to “oversee and ensure the implementation of Strategic Readiness Review (SRR) and Comprehensive Review (CR) recommendations” as well as to “assess the overall health and effectiveness of DON efforts to reform and improve readiness.”²⁵⁸ Admiral Moran, Vice Chief of Naval Operations, provided an annual update on the progress of the RROC in February 2019. Among the highlighted accomplishments:

- “91 of the remaining [111] recommendations of the Strategic Readiness Review (SRR) and Comprehensive Review (CR) have been implemented.”
- “[O]ur Force Generation strategy, the process by which we certify ships for sea, was completely restructured. Today, any operations outside the guidance established by the Surface Force Commander require[] notification of a Four-Star Fleet Commander to ensure visibility and accountability.”
- “Fleet Commanders conducted Ready-for-Sea Assessments to ensure appropriate manning levels, training certification, and equipment status for every operational

ship at sea. Fifteen of eighteen Forward Deployed Naval Force-Japan (FDFNF-J) ships were assessed as ready for sea. The three remaining ships were immediately sidelined for additional training and maintenance prior to getting underway.”

- “FDFNF manning requirements were formally assigned higher priority than Continental United States (CONUS) requirements for sea and shore billets, respectively.... Currently across FDFNF, at-sea billets are filled at 100% in the aggregate, compared to the Navy-wide average of 95%.”
- “The revised SWO career path will increase time at sea during an officer’s first sea tour (48 total months).... The Mariner Skills Training Program (MSTP) takes a holistic view of the career path, delivering improved Junior Officer of the Deck training (May 2019) [and] Officer of the Deck courses (May 2021).... In July 2018, Surface Warfare Officers School (SWOS) trainees were recertified as U.S. Coast Guard Standards of Training, Certification, & Watchkeeping (SCTW) compliant.... SWOs will have proficiency measured via ten Career Milestone assessments.”²⁵⁹

In his FY 2020 Posture Statement, Admiral Richardson stated that:

PB-20 assigns the highest funding priority to CR/SRR-related investments—\$346 million in FY-20 and \$1.1 billion over the FYDP.... Additionally, we remain committed to assessing our ships and crews, understanding the impact of fatigue and other human factors, filling personnel gaps for ships on deployment or in sustainment, and dedicating time to maintain our forward-deployed Fleet.²⁶⁰

Admiral Richardson’s statement and the RROC’s accomplishments to date demonstrate that Navy leadership has taken the tragedies

of 2017 to heart and is committed to restoring surface warfare proficiency and readiness. Unfortunately, it will take several years to implement all corrective actions and even longer for these efforts to translate into satisfactory material and training readiness across the entire surface fleet.

The Navy's readiness as it pertains to providing global presence is rated "marginal." The level of CCDR demand for naval presence and the fleet's ability to meet that demand are similar to those found in the *2019 Index* but are still challenged by the range of funding problems noted in this section. The Navy maintains its ability to forward deploy approximately one-third of its fleet and has been able to stave off immediate readiness challenges through the OFRP.

The Navy's readiness corrective actions, coupled with an inadequate fleet size, have reduced its ability to respond to CCDR requirements for sustained presence, crisis support, and surge response in the event of a major conflict. Since CCDR demand signals have become insatiable in recent years, recent actions by the Navy to prioritize maintenance and training over peacetime deployments have created a more realistic and sustainable OP-TEMPO for missions short of major conflict. The Navy's actions to improve training and efficiency for the fleet and specifically for the surface warfare community will help to correct the systemic issues that led to severely degraded operational proficiency, but it will be several years before they can fully change the culture and raise the level of the fleet's overall professional knowledge and experience.

Even with prioritized investments in ship and aircraft maintenance at the maximum executable levels of the Navy's ship and aircraft depots, the Navy still cannot meet the maintenance requirement for FY 2020. Without increased and sustained funding to meet the Navy's fleet recapitalization requirements and improvements in shipyard maintenance capacity, the readiness of the Navy's fleet will remain compromised.

Although the Navy has made strides in arresting its readiness decline since Admiral Moran expressed his concerns about the Navy's ability to handle two major crises more than a year ago, the gains have not been sufficient to justify an assumption that his concerns do not still hold true today. The escalating depot maintenance demands of a growing fleet, coupled with several attack submarine refueling overhauls in the near future, could amplify ship maintenance backlogs before the effects of shipyard modernization and a larger maintenance workforce are felt. The short-term readiness gains made in the Navy's strike fighter inventory must be sustained and applied across the entire naval aviation enterprise.

Overall U.S. Navy Score: Marginal

The Navy's overall score for the *2020 Index* is "marginal," the same as it was in the *2019 Index*. This was derived by aggregating the scores for capacity ("weak"); capability ("marginal"); and readiness ("marginal").

The Navy has prioritized restoring material and warfighting readiness, and this has been matched by increased funding since 2017. However, despite some incremental improvements, the competing effects of growing maintenance demands versus the extended timeline to increase public shipyard capacity and efficiency could mitigate or reverse these gains. Similarly, the Navy's FY 2020 shipbuilding plan and modernization plans forecast a larger and more lethal fleet, but funding limitations will make it extremely difficult for the Navy to increase capacity and field new lethal capabilities in the near term.

Unless Defense Department leadership and Congress can provide a sustained increase in procurement and research and development funding, the plans to build a bigger and better Navy will be curtailed. This could result in future degradation of the Navy's capacity and capability scores.

U.S. Military Power: Navy

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity		✓			
Capability			✓		
Readiness			✓		
OVERALL			✓		

NAVY SCORES

1 2 3 4 5
Weakest ← Strongest

Procurement and Spending ■ Through FY 2019
■ Pending

Aircraft Carrier

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<i>Nimitz-Class Aircraft Carrier (CVN-68)</i> Inventory: 10 Fleet age: 28 Date: 1975 The <i>Nimitz</i> -class is a nuclear powered multipurpose carrier. The aircraft carrier and its embarked carrier air wing can perform a variety of missions including maritime security operations and power projection. Its planned service life is 50 years. The class will start retiring in FY 2025 and will be replaced by the <i>Ford</i> -class carriers.	3	3	<i>Ford-Class Aircraft Carrier (CVN-78)</i> Timeline: 2017-2032 Currently in production, the <i>Ford</i> -class will replace the current <i>Nimitz</i> -class aircraft carriers. The <i>Ford</i> -class design uses the basic <i>Nimitz</i> -class hull form but incorporates several improvements: 33 percent higher sortie rate; a smaller crew with approximately 600 fewer sailors; two and a half times greater electrical power, and over \$4 billion in life cycle cost savings over the <i>Nimitz</i> -class.	2	2
<i>Ford-Class Aircraft Carrier (CVN-78)</i> Inventory: 1 Fleet age: 2 Date: 2017 The <i>Ford</i> -class incorporates new technologies that will increase aircraft sortie rates, reduce manning, provide greater electrical power for future weapons systems, and decrease operating costs. Its planned service life is 50 years.	5	4	<div> PROCUREMENT <div> <div></div> <div>37</div> </div> </div> <div> SPENDING (\$ millions) <div> <div></div> <div>\$29,787\$19,410</div> </div> </div>		

NOTE: See page 392 for details on fleet ages, dates, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2019
■ Pending

Large Surface Combatant

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<i>Ticonderoga-Class Cruiser (CG-47)</i> Inventory: 22 Fleet age: 29 Date: 1983 The <i>Ticonderoga</i> -Class is a multi-mission battle force ship equipped with the Aegis Weapons System. While it can perform strike, anti-surface warfare and anti-submarine warfare, its primary focus is air and missile defense. Between FY 2021 and 2024, the Navy plans to retire eight of the 22 CGs, given their life expectancy of 40 years.	2	3	<i>Zumwalt-Class Destroyer (DDG-1000)</i> Timeline: 2016–2022 The DDG-1000 was designed to be a new-generation destroyer capable of handling more advanced weapon systems with modern gun systems and a hull design aimed to reduce radar detectability for its primary mission of naval surface fire support (NSFS). The DDG-1000 program was intended to produce a total of 32 ships, but this number was reduced to 3. The first DDG-1000 was commissioned in October 2016. PROCUREMENT <div><div></div>3</div> SPENDING (\$ millions) <div><div></div>\$12,987</div> <div><div></div>\$208</div>	1	1
<i>Zumwalt-Class Destroyer (DDG-100)</i> Inventory: 1 Fleet age: 3 Date: 2016 The <i>Zumwalt</i> -Class is a multi-mission destroyer that incorporates several technological improvements, such as a stealthy hull design and integrated electric-drive propulsion system. Although it has passed sea trials, it continues to experience problems with its combat systems. The third and final ship of the class is expected to be commissioned in late FY 2019.	5	2			
<i>Arleigh Burke-Class Destroyer (DDG-51)</i> Inventory: 67 Fleet age: 17 Date: 1991 The <i>Arleigh Burke</i> -Class is a multi-mission guided missile destroyer featuring the Aegis Weapons System with a primary mission of air defense. The Navy plans to extend the service life of the entire class to 45 years from its original life expectancy of 35–40 years.	4	4	<i>Arleigh Burke-Class Destroyer (DDG-51)</i> Timeline: 1991–2029 DDG-51 production was restarted in FY 2013 to make up for the reduction in DDG-1000 acquisitions. Beginning in FY 2017, all DDG-51s procured will be the Flight III design, which includes the Advanced Missile Defense Radar (AMDR), a more capable missile defense radar. PROCUREMENT <div><div></div>82</div> <div><div></div>15</div> SPENDING (\$ millions) <div><div></div>\$89,948</div> <div><div></div>\$28,020</div>	4	4



NOTE: See page 392 for details on fleet ages, dates, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ← Strongest

Procurement and Spending ■ Through FY 2019
■ Pending

Small Surface Combatant

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Littoral Combat Ship (LCS) Inventory: 17 Fleet age: 3 Date: 2008 The Littoral Combat Ship includes two classes: the <i>Independence</i> -class and the <i>Freedom</i> -class. The modular LCS design depends on mission packages (MP) to provide warfighting capabilities in the SUW, ASW, and MCM mission areas. The ship has an expected service life of 25 years.	5		Littoral Combat Ship (LCS) Timeline: 2009–2019 The LCS is intended to fulfill the mine countermeasure, antisubmarine warfare, and surface warfare roles for the Navy. It will be the only small surface combatant in the fleet once the Navy's MCM ships retire. A new program called the FFG(X) will fill out the remaining 20-ship small surface combatant requirement.	2	2
Avenger-Class Mine Counter Measure (MCM-1) Inventory: 11 Fleet age: 27 Date: 1989 <i>Avenger</i> -class ships are designed as mine sweepers/hunter-killers capable of finding, classifying, and destroying moored and bottom mines. The class has an expected 30-year service life. The remaining MCMs are expected to be decommissioned throughout the 2020s. While there is no direct replacement single mission MCM ship in production, the Navy plans to fill its mine countermeasure role with the LCS and its MCM MP.	1	2	PROCUREMENT  33	SPENDING (\$ millions)  \$16,719 \$80	

SSGN Cruise Missile Submarine

PLATFORM	Age Score	Capability Score	MODERNIZATION PROGRAM	Size Score	Health Score
Ohio-Class (SSGN-726) Inventory: 4 Fleet age: 36.5 Date: 1981 The SSGNs provide the Navy with a large stealthy strike and special operations mission capabilities. From 2002–2007, the four oldest <i>Ohio</i> -class ballistic missile submarines were converted to guided missile submarines. Each SSGN is capable of carrying up to 154 Tomahawk land-attack cruise missiles and up to 66 special operations forces for clandestine insertion and retrieval. All four SSGNs will retire between FY 2026–2028. The Navy has tentative plans to replace the SSGNs with a new Large Payload Submarine beginning in FY 2036.	2	4	None		

NOTE: See page 392 for details on fleet ages, dates, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2019
■ Pending

Attack Submarines

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Seawolf-Class (SSN-21) Inventory: 3 Fleet age: 19 Date: 1997 The <i>Seawolf</i> -class is exceptionally quiet, fast, well-armed, and equipped with advanced sensors. Though lacking a vertical launch system, the <i>Seawolf</i> -class has eight torpedo tubes and can hold up to 50 weapons in its torpedo room. Although the Navy planned to build 29 submarines, the program was cut to three submarines. The <i>Seawolf</i> -class has a 33-year expected service life. They have been succeeded by the <i>Virginia</i> -class attack submarine.	3	4	Virginia-Class (SSN-774) Timeline: 2004–2019 The Virginia Payload Module (VPM) will be incorporated into eight of the 11 planned Block V submarines beginning in FY 2019. VPM includes four large-diameter, vertical launch tubes that can carry up to 28 additional Tomahawk missiles or other payloads. PROCUREMENT <div><div></div><div></div></div> <div>3028</div> SPENDING (\$ millions) <div><div></div><div></div></div> <div>\$79,794\$68,285</div>	2	3
Los Angeles-Class (SSN-688) Inventory: 31 Fleet age: 28 Date: 1976 The <i>Los Angeles</i> -class comprises the largest portion of the Navy's attack submarine fleet. They are multi-mission submarines that can perform covert intelligence collection, surveillance, ASW, ASuW, and land attack strike. The <i>Los Angeles</i> -class has a 33-year expected service life. The last <i>Los Angeles</i> -class submarine is expected to retire in the late 2020s and is being replaced by the <i>Virginia</i> -class.	1	3			
Virginia-Class (SSN-774) Inventory: 17 Fleet age: 7 Date: 2004 The <i>Virginia</i> -class is the U.S. Navy's next-generation attack submarine. The <i>Virginia</i> -class includes several improvements over previous attack submarine classes that provide increased acoustic stealth, improved SOF support, greater strike payload capacity, and reduced operating costs. The planned service life of the <i>Virginia</i> -class is 33 years. The <i>Virginia</i> -class is in production and will replace the <i>Los Angeles</i> -class and <i>Seawolf</i> -class attack submarines as they are decommissioned.	4	4			

NOTE: See page 392 for details on fleet ages, dates, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ← Strongest

Procurement and Spending ■ Through FY 2019
■ Pending

SSBN Ballistic Missile Submarine

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Ohio-Class (SSBN) Inventory: 14 Fleet age: 28.5 Date: 1981 The <i>Ohio</i> -class SSBN is the most survivable leg of the U.S. military's strategic nuclear triad. The <i>Ohio</i> SSBN's sole mission is strategic nuclear deterrence, for which it carries long-range submarine-launched ballistic missiles. The <i>Ohio</i> -class's expected service life is 42 years. The <i>Ohio</i> -class fleet will begin retiring in 2027 at an estimated rate of one submarine per year until 2039. The <i>Ohio</i> -class is being replaced by the <i>Columbia</i> -class SSBN	2	4	Columbia-Class (SSBN-826) The <i>Columbia</i> -class SSBN is the Navy's highest priority program. The 12 boats in the program will replace the current fleet of 14 <i>Ohio</i> -class ballistic missile submarines, with acquisition of the first boat to occur in FY 2021. The program will extend through the mid-2030s.		

Amphibious Warfare Ship

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Wasp-Class Amphibious Assault Ship (LHD-1) Inventory: 8 Fleet age: 22 Date: 1989 The <i>Wasp</i> -class can support amphibious landing operations with Marine Corps landing craft via its well deck. It can also support a Marine Air Combat Element operations with helicopters, tilt-rotor aircraft and Vertical/Short Take-Off and Landing (V/STOL). This ship has a planned 40-year service life.	3	3	America-Class (LHA-6) Timeline: 2004-TBD LHA Flight 0 (LHA-6 and 7) were built without a well deck to provide more space for Marine Corp aviation maintenance and storage as well as increased JP-5 fuel capacity. LHA Flight 1 (LHA-8 and beyond) will reincorporate a well deck for increased mission flexibility. The America-class is in production with three LHA-6s already fully procured. Advance procurement for LHA 9 will begin in FY 2023.	3	3
America-Class Amphibious Assault Ship (LHA-6) Inventory: 1 Fleet age: 5 Date: 2014 This new class of large-deck amphibious assault ships is meant to replace the retiring <i>Wasp</i> -Class LHD. LHAs are the largest of all amphibious warfare ships, resembling a small aircraft carrier. The America-class is designed to accommodate the Marine Corps' F-35Bs.	5	4	<div> PROCUREMENT </div> <div> SPENDING (\$ millions) </div>		





NOTE: See page 392 for details on fleet ages, dates, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest → Strongest

Procurement and Spending ■ Through FY 2019
■ Pending

Amphibious Warfare Ship

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
San Antonio-Class Amphibious Transport Dock (LPD-17) Inventory: 11 Fleet age: 8 Date: 2006 The LPDs have well decks that allow the USMC to conduct amphibious operations with its landing craft. The LPD can also carry 4 CH-46s or 2 MV-22s. 11 of the planned 13 Flight I LPD-17-class ships are operational with the remaining two under construction. The class has a 40-year planned service life.	5		San Antonio-Class Amphibious Transport Dock (LPD-17) Timeline: 2006–2017 The LPD-17s are replacements for the <i>San Antonio</i> -class LPDs. All 13 LPD-17s have been procured. Both Flight I and Flight II LPDs are multi-mission ships designed to embark, transport, and land elements of a Marine landing force by helicopters, tilt-rotor aircraft, landing craft, and amphibious vehicles. PROCUREMENT  13 SPENDING (\$ millions)  \$21,309 \$63	5	4
Whidbey Island-Class Dock Landing Ship (LSD-41) Inventory: 8 Fleet age: 30 Date: 1985 LSD-41 <i>Whidbey Island</i> -class ships were designed specifically to transport and launch four Marine Corps Landing Craft Air Cushion vehicles. They have an expected service life of 40 years. All eight ships in the class will retire between FY 2026–2033. LSD-41-class will be replaced by LPD-17 Flight II program, which began procurement in FY 2018.	2	3	LPD-17 Flight II Timeline: 2025–TBD Previously known as LX(R), the LPD-17 Flight II program will procure 13 ships to replace the Navy's LSD-type ships. The Navy originally planned to procure the first Flight II ship in FY 2020, however accelerated procurement funding enabled procurement of the first LPD-17 Flight II in FY 2018. The Navy delayed the second ship planned for FY 2020 until FY 2021.	5	4
Harpers Ferry-Class Dock Landing Ships (LSD-49) Inventory: 4 Fleet age: 23 Date: 1994 The <i>Harpers Ferry</i> -class reduced LCAC capacity to two while increasing cargo capacity. It has an expected service life of 40 years and all ships will be retired by FY 2038. The LSD-49 will be replaced by the LPD-17 Flight II, which began procurement in FY 2018.		3	PROCUREMENT  1 8 SPENDING (\$ millions)  \$2,164 \$3,577		

NOTE: See page 392 for details on fleet ages, dates, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ← Strongest

Procurement and Spending ■ Through FY 2019 ■ Pending

Airborne Early Warning

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
E-2C Hawkeye Inventory: 28 Fleet age: 36 Date: 1973 The E-2C Hawkeye is a battle management and airborne early warning aircraft. The E-2C fleet received a series of upgrades to mechanical and computer systems around the year 2000. While still operational, the E-2C is nearing the end of its service life and is being replaced by the E-2D Advanced Hawkeye.	1	3	E-2D Advanced Hawkeye Timeline: 2014–2022 The E-2D Advanced Hawkeye replaces the legacy E-2C and is in production. The Navy received approval for a five year multi-year procurement plan beginning in FY 2019 for 24 aircraft to complete the program of record.	4	4
E-2D Advanced Hawkeye Inventory: 12 Fleet age: 3 Date: 2014 The E-2D program is the next generation, carrier-based early warning, command, and control aircraft that provides improved battle space detection, supports theater air missile defense, and offers improved operational availability.	5	4	<div> <div> PROCUREMENT <div> <div></div> <div>96</div> <div>18</div> </div> </div> <div> SPENDING (\$ millions) <div> <div></div> <div>\$14,483</div> <div>\$3,910</div> </div> </div> </div>		

Electronic Attack Aircraft

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
EA-18G Growler Inventory: 75 Fleet age: 6 Date: 2009 The EA-18G Growler is the U.S. Navy's primary electronic attack aircraft, providing tactical jamming and suppression of enemy air defenses. The final EA-18G aircraft was delivered in FY 2018, bringing the total to 160 aircraft and fulfilling the Navy's requirement. It replaced the legacy EA-6B Prowlers.	5	4	None		

NOTE: See page 392 for details on fleet ages, dates, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2019 ■ Pending

Fighter/Attack Aircraft

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
F/A-18E/F Super Hornet Inventory: 546 Fleet age: 15 Date: 2001 The F/A-18E/F Super Hornet has longer range, greater weapons payload, and increased survivability when compared with the F/A-18A-D Legacy Hornet. The Navy plans to achieve a 50/50 mix of two F-35C squadrons and two F/A-18E/F Block III squadrons per carrier air wing by the mid-2030s. The ongoing service life extension program will extend the life of all Super Hornets to 9,000 flight hours.	3	3	F-35C Joint Strike Fighter Timeline: 2019-TBD The C-variant is the Navy's 5th generation aircraft, bringing radar-evading technology to the carrier deck for the first time. The F-35C performs a variety of missions to include air-to-air combat, air-to-ground strikes, and ISR missions. PROCUREMENT <div><div></div><div>98271</div></div> SPENDING (\$ millions) <div><div></div><div>\$19,549\$35,727</div></div>	2	3
F-35C Joint Strike Fighter Inventory: 30 Fleet age: 1 Date: 2019 The F-35C is the Navy's variant of the Joint Strike Fighter.	5	4			

NOTES: See Methodology for descriptions of scores. Fleet age is the average of platform since commissioning. The date for ships is the year of commissioning. Inventory for aircraft is estimated based on the number of squadrons. The date for aircraft is the year of initial operational capability. The timeline for ships is from the year of first commissioning to the year of last delivery. The timeline for aircraft is from the year of first year of delivery to the last year of delivery. Spending does not include advanced procurement or research development test and evaluation. The total program dollar value reflects the full F-35 joint program, including engine procurement. The Navy is also procuring 67 F-35Cs for the Marine Corps. Age of fleet is calculated from date of commissioning to January 2016.

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223. This requirement is derived from the BUR’s requirement for four–five carrier strike groups per MRC; however, this *Index* finds that this number is low by historical accounts and therefore recommends one additional carrier per MRC.
224. The 2016 Force Structure Assessment established a requirement for “[a] minimum of 12 Aircraft Carriers...to meet the increased warfighting response requirements of the Defense Planning Guidance Defeat/Deny force sizing direction.” U.S. Navy, “Executive Summary: 2016 Navy Force Structure Assessment (FSA),” p. 3.
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229. U.S. Navy, “The Carrier Air Wing,” <http://www.navy.mil/navydata/ships/carriers/powerhouse/airwing.asp> (accessed August 8, 2019).
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231. Table, “Features of Recent Navy Force Structure Plans,” in O’Rourke, “Navy Force Structure and Shipbuilding Plans,” p. 43, note 44.
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234. U.S. Marine Corps, “Concepts and Programs: Types of MAGTFs,” <http://www.candp.marines.mil/Organization/MAGTF/Types-of-MAGTFs/> (accessed August 8, 2019). See especially the included graphic, “Notional Laydown of a Marine Expeditionary Brigade (MEB).”
235. *Ibid.*
236. The Navy defines the requirements for an ESG as follows: “[a] minimum of three amphibious ships” based on Combatant Commander requirements and missions, including “[a]t least one amphibious assault ship, multi- or general purpose ship (landing ship assault (LHA) [or] landing helicopter dock (LHD));” “[a]t least one amphibious transport dock (LPD);” and “[a]t least one amphibious dock landing ship (LSD).” An ESG may also include “other forces assigned (surface combatants and auxiliary support vessels will be similar to those assigned to a CSG dependent on the threat and capabilities of the ships assigned).” U.S. Department of the Navy, Office of the Chief of Naval Operations, “Force Composition of Afloat Navy and Naval Groups,” Enclosure (2), “Amphibious Ready Group and Marine Expeditionary Unit,” p. 1, and Enclosure (3), “Expeditionary Strike Group.”

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