# U.S. Navy

In *A Design for Maintaining Maritime Superiority, Version 1.0,* issued in January 2016, Chief of Naval Operations Admiral John M. Richardson describes the U.S. Navy's mission as follows:

> 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]

The March 2015 update to *A Cooperative Strategy for 21st Century Seapower* provided the basis for understanding the key functions necessary to accomplish this mission.[2]

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 land forces (or even, to a large extent, air forces), which are tethered to a set of fixed, larger-scale support bases that require consent from host nations, the U.S. Navy can operate freely across the globe and shift its presence wherever 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. In addition to the ability to project combat power rapidly anywhere in the world, 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 2018 National Defense Strategy (NDS);[3]

- The Global Force Management Allocation Plan (GFMAP);[4]
- The 2015 update to *A Cooperative Strategy for 21st Century Seapower*; and
- The 2016 *Design for Maintaining Maritime Superiority, Version 1.0*.

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]

In addition, the U.S. Navy must meet forward presence requirements laid out in the fiscal year (FY) 2017 GFMAP, which specifies the force presence needed around the world as determined by the combatant commanders (COCOMs) and the Secretary of Defense. To meet the objectives of the NDS and GFMAP, "the Navy and Marine Corps primary combat force contributors are two Carrier Strike Groups (CSGs) and two Amphibious Ready Groups (ARGs) 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's maritime manifestation of the NDS, the *Navy the Nation Needs (NNN)*, stresses that credible and effective naval power is based on six key pillars—Readiness, Capability, Capacity, Manning, Networks, and Operating Concepts—and that:

> These six pillars must remain balanced and scalable in order to field the needed credible naval power, guarding against over-investment in one area that might disadvantage another. This disciplined approach ensures force structure growth accounts for commensurate, properly phased investments across all six pillars—a balanced warfighting investment strategy to fund the total ownership cost of the Navy (manning, support, training, infrastructure, etc.).[8]

This *Index* focuses on three of these pillars—capacity, capability, and readiness—as the primary means to measure U.S. naval strength.

- Sufficient capacity is required 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 also 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 performance measures 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 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. The Navy focuses mainly on the size of its "battle force," which is composed of ships it considers to be directly related to its combat missions.[9]

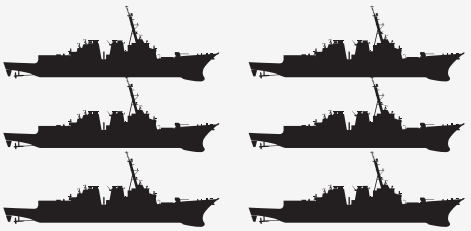
FIGURE 2

## 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.

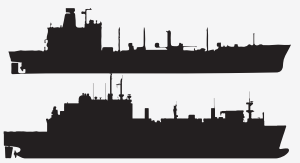


**Guided Missile Cruiser (CG)**
Large surface combatant (LSC) capable of conducting integrated air and missile defense (IAMD), anti-air warfare (AAW), anti-surface warfare (ASuW), and anti-submarine warfare (ASW). CGs are the preferred platform for serving as the Air and Missile Defense Commander.

**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)**
Multi-mission 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.



**SOURCE:** The Heritage Foundation research.

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The first edition of this *Index* established a benchmark of 346 ships for the minimum battle force fleet required to "fight and win two MRCs and a 20 percent margin that serves as a strategic reserve" as well as maintain a peacetime global forward 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 groundwork for this year's *Index* 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 to determine whether the *Index* benchmark should be updated.

To provide the 13 carrier strike groups and 12 expeditionary strike groups (ESGs) required to meet the simultaneous two-MRC construct, meet the historical steady-state demand of approximately 100 ships constantly forward deployed, and ensure that ships and aircraft are properly maintained and sailors are adequately trained to "fight tonight," this *Index* assesses that the U.S. requires a minimum of 400 ships. While this represents a significant increase both from the previous benchmark of 346 ships and 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,"[10] the Navy's recent fleet readiness issues and the 2018 NDS's focus on the "reemergence of long-term strategic competition"[11] 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 not only includes 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 shipbuilding industrial base capacity, this *Index* benchmark is budget agnostic and based strictly on assessed force-sizing requirements.

The Navy currently sails 284 vessels as part of its battle force fleet,[12] up from 276 in 2017[13] 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 2018 NDAA provides $23.8 billion for the construction of 14 new ships, including one additional Littoral Combat Ship (LCS); accelerates the procurement of the first LPD Flight II and one additional Expeditionary Fast Transport (T-EPF); and adds one ocean survey ship (T-AGS).[14] The Navy has requested the procurement of 10 ships in FY 2019. This is two fewer than recommended in the Congressional Budget Office (CBO) assessment of the average annual ship procurement needed to achieve a 355-ship fleet by 2037.[15]

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 six additional ships and submarines by the end of 2018[16] and 11 ships and submarines in FY 2019.[17] It also will retire one *Los Angeles*-class nuclear attack submarine (SSN) in FY 2019.[18] The number of ships decommissioned will increase significantly over the next five years as additional *Los Angeles*-class SSNs and mine countermeasure ships (MCMs) reach the end of their service life, slowing the pace at which fleet size can grow.[19] The Navy recently completed a technical evaluation of the "feasibility of extending the service life of selected non-nuclear vessels" and may decide to extend the life of numerous ship 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.[20]

The largest proportional shortfall in the Navy fleet assessed in the *2019 Index* is the same as in past editions: small surface combatants.[21] The Navy's current SSC inventory include 13 Littoral Combat Ships and 11 MCM ships for a total of 24 SSCs,[22] 28 below the

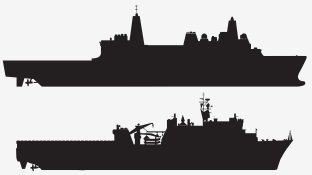
FIGURE 3

## Expeditionary Strike Group

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

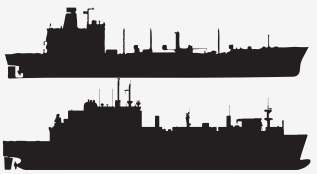
**Amphibious Assault Ship LHA or LHD**
A landing helicopter assault ship (LHA) or landing helicopter dock (LHD). Capable of supporting short take-off vertical landing (STOVL) operations for embarked Marine strike aircraft squadron as well as tilt-rotor and helicopter squadrons. Some of these ships possess 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)**
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.

**SOURCE:** The Heritage Foundation research.

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objective requirement of 52 established by the Navy[23] and 47 less than the 2018 Heritage Foundation requirement of 71.[24]

The next largest shortfall occurs in CLF ships. The Navy's current CLF inventory is comprised of 12 *Lewis and Clark*-class dry cargo and ammunition ships (T-AKE); 15 *Henry J. Kaiser*-class fleet replenishment oilers (T-AO); and two *Supply*-class fast combat support ships (T-AOE), for a total of 29 CLF ships.[25] This is three below the Navy requirement of 32 ships and 25 less than the *Index* requirement of 54.[26]

The aircraft carrier force suffers a capacity shortfall of two hulls: 11 are currently in the fleet, and the two-MRC construct requires 13.[27] Current U.S. law requires the Navy to maintain

FIGURE 4

## 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 properly handle this large mission, Heritage Foundation experts recommend a fleet of 13 carriers.


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a force of "not less than 11 operational aircraft carriers."[28] Representative K. Michael Conaway (R–TX) introduced an amendment to H.R. 5515, the National Defense Authorization Act (NDAA) for Fiscal Year 2019, that would have amended U.S. Code, Title 10, § 5062(b), effective September 30, 2022, to require a minimum of "12 operational aircraft carriers," that the U.S. Navy "expedite delivery of 12 aircraft carriers," and that "an aircraft carrier should be authorized every three years" to keep pace with the loss of carriers as they are retired.[29] The final version of the NDAA as enacted specifies only that "It is 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."[30]

The Congressional Research Service (CRS) has assessed that "increasing aircraft carrier procurement from the currently planned rate of one ship every five years...to a rate of one ship every three years...would achieve a 12-carrier force on a sustained basis by about 2030...."[31] The Navy has stated that with its current fleet of only 11 carriers, it cannot meet the requirement to maintain two carriers deployed at all times and three ready to surge deploy within 30 days.[32]

The carrier force fell to 10 from December 2012 until July 2017. During the first week of January 2017, for the first time since World War II, no U.S. aircraft carriers were deployed.[33] 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, it will not be ready for routine flight operations until 2020 and will not operationally deploy until 2022.[34] 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. Although the carrier in RCOH will count as a battle force ship, it 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.

In December 2016, the U.S. Navy released its latest study of forecasted fleet requirements. The Navy Force Structure Assessment (FSA) was developed to determine the correct balance of existing forces for "ever-evolving and increasingly complex maritime security threats."[35] 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. 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 accept risk in providing continual presence missions.[36] 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."[37]

The final recommendation for a 355-ship force 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 (DDG) and cruisers (CG)), 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.[38]

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."[39] According to the CBO:

> [O]ver the next 30 years, meeting the 355-ship objective would cost the Navy an average of about $26.6 billion (in 2017 dollars) annually for ship construction, which is more than 60 percent above the average amount the Congress has appropriated each year for that purpose over the past 30 years and 40 percent more than the amount appropriated for 2016.[40]

The Navy's SCN (Shipbuilding and Conversion, Navy) request for FY 2019 totaled approximately $21.8 billion,[41] well below the level that the CBO has assessed is necessary to reach fleet goals. As noted, this includes funding for procurement of only 10 battle force ships during this fiscal year, which will make it difficult to increase the fleet size.

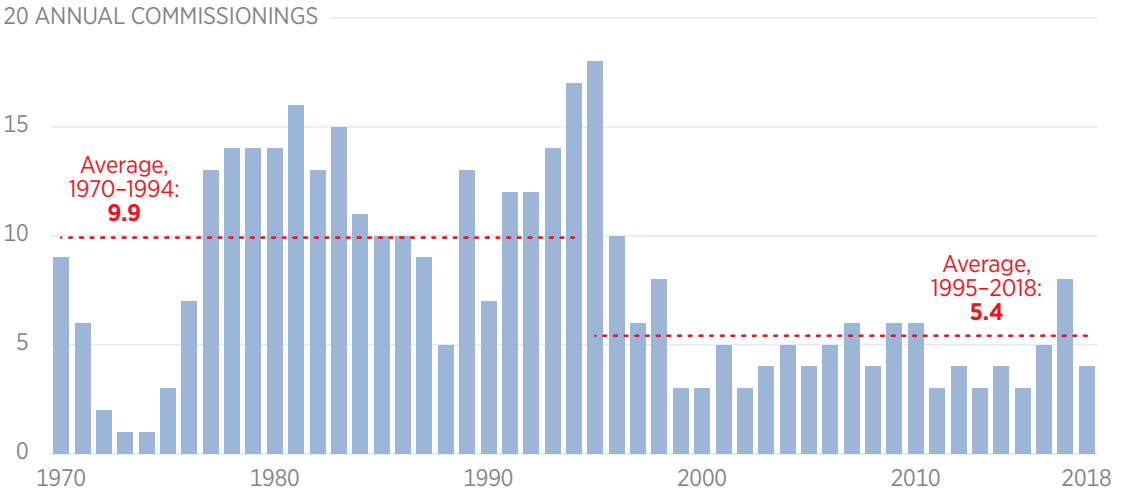
The seeming anomaly of increased funding for shipbuilding without a corresponding increase in fleet force structure is due in part to the fact that a significant portion of this funding is dedicated to advanced procurement of the next-generation ballistic missile submarine program (SSBN(X) *Columbia*-class).[42] Additionally, the CRS has estimated that "roughly 15,000 additional sailors and aviation personnel would be needed at sea to operate those 47 additional ships."[43] Although the Department of Defense updated the NDS in early 2018, the Navy has not formally announced any intention to update its 2016 FSA to reflect this new guidance.

The Navy released its *Report to Congress on the Annual Long-Range Plan for the Construction of Naval Vessels for Fiscal Year 2019* (or the 30-year shipbuilding plan) in February

CHART 10

## 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.




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

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2018. This updated plan provides the foundation for building the *Navy the Nation Needs* and ultimately achieving the congressionally mandated requirement for 355 battle force ships. While this plan includes 54 ships within the Future Years Defense Program (FYDP) FY 2019–FY 2023 and 301 ships over the next 30 years, it fails to achieve a 355-ship Navy until beyond 2050. Of significant note, the plan will only reach the 2016 FSA requirements for attack submarines, ballistic submarines, and combat logistics force ships by 2048.[44] The plan averages 10 new ships per year, two fewer than the average number of new ships per year that the CBO assesses is required to reach 355 ships by 2037.[45]

The 30-year shipbuilding plan also includes plans for service life extensions (SLEs) for qualified candidate vessels. The Navy's FY 2019 budget submission includes SLEs for six *Ticonderoga*-class cruisers, four mine countermeasure ships, and the first of potentially five improved *Los Angeles*-class attack submarines.[46] On April 12, 2018, Vice Admiral William Merz, Deputy Chief of Naval Operations for Warfare Systems, informed the House Armed Services Committee's Seapower and Force Projection Subcommittee that the Navy will extend the entire *Arleigh Burke* destroyer class to a service life of 45 years, enabling the Navy to achieve 355 ships by 2036 or 2037.[47] This destroyer class extension will not provide the required mix of ships per the 2016 FSA, but it will provide additional fleet capacity.

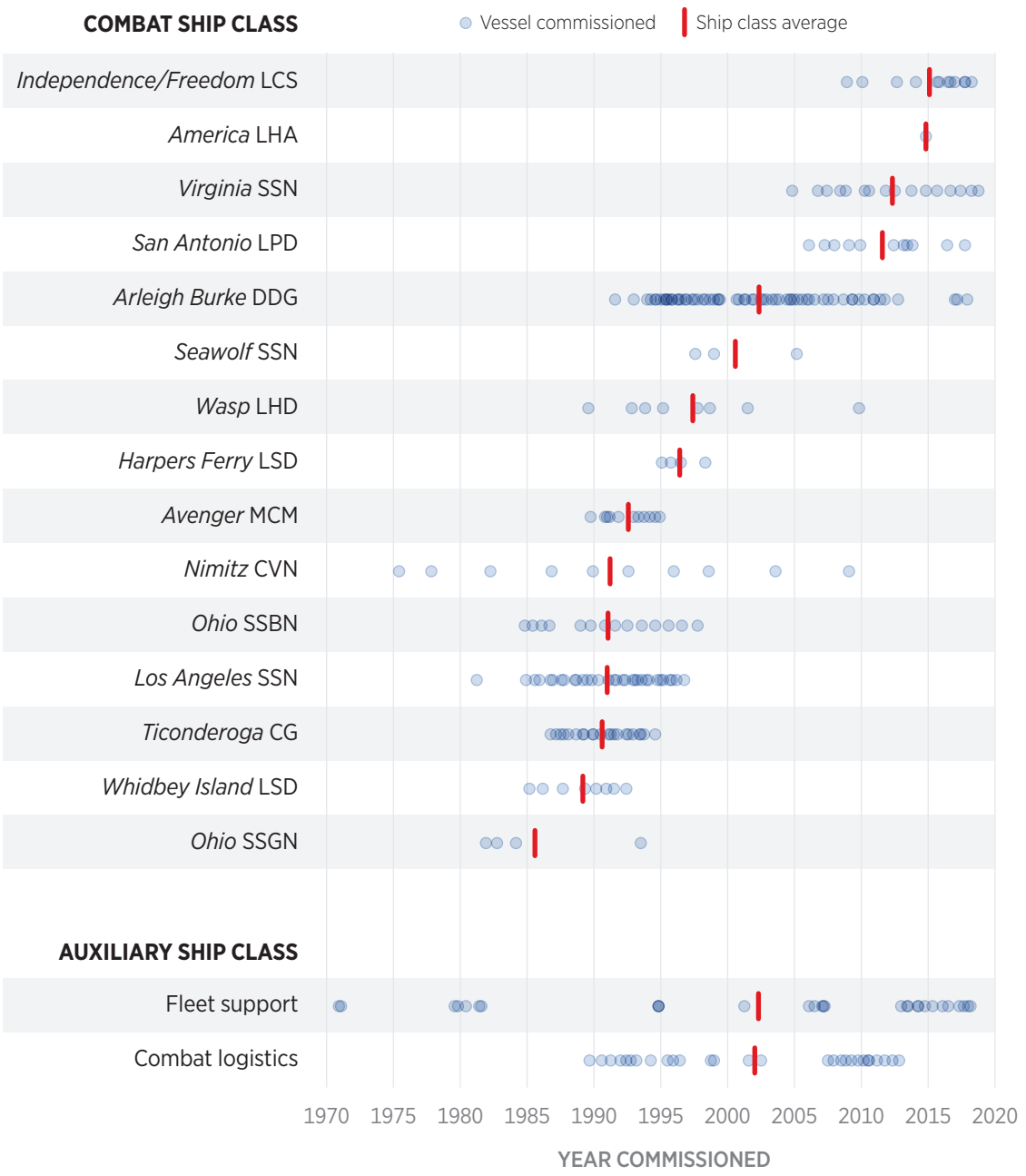
Taken alone, total fleet size can be a misleading statistic; related factors must also be taken into account when considering numbers of ships. One such important factor is the number of ships that are forward deployed to meet operational demands. On average, the Navy maintains approximately one-third of the total fleet deployed at any given time (90–100 ships). 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

CHART 11

# 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 has resulted in a fleet of increasing age.




**NOTE:** Data are current as of July 30, 2018.
**SOURCE:** Naval Sea Systems Command, Naval Vessel Register, "Fleet Size," http://www.nvr.navy.mil/NVRSHIPS/ FLEETSIZE.HTML (accessed August 6, 2018).

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based in the continental United States (CONUS) to undergo routine maintenance and training, as well as to limit deployment time for sailors. However, given the COCOMs' requirements for naval power presence in each of their regions, there is 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."[48] The plan incorporates four phases of ship availability/maintenance, resulting in a basic ratio of 4:1 for CONUS-based force structure required for deployed platforms. The OFRP is on track to achieve the Navy's goal of "2 deployed and 3 surge ready" carrier strike groups just beyond 2021.[49]

In 2017, the Navy had 104 ships deployed globally (including submarines): 38 percent of the total battle force fleet and an increase from the 94 deployed in 2016.[50] As of August 17, 2018, the Navy had 89 "Deployed Battle Force Across the Fleet Including Forward Deployed Submarines."[51] A primary factor in this decrease is the Navy's improved focus on restoring surface fleet material and mission proficiency readiness following the deadly Seventh Fleet collisions of 2017. 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 both 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):[52]

- **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.[53] 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. However, these options allow one ship to provide a greater level of presence than four ships based in CONUS and in rotational deployment because they offset the time needed to deploy ships to distant theaters.[54] 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.[55]

### Capability

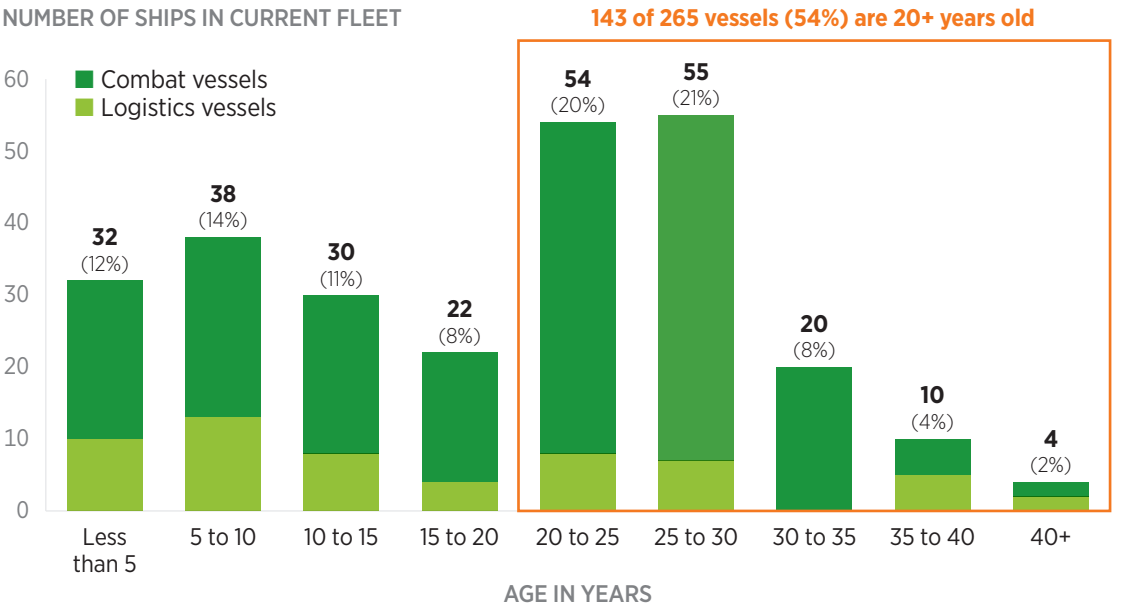
Scoring the U.S. Navy's overall ability to protect U.S. interests globally is not simply a matter of counting the fleet. The quality of the battle force is also important in determining naval strength.

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 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

CHART 12

## An Aging U.S. Navy




**NOTE:** Data are current as of August 15, 2018.
**SOURCE:** Naval Sea Systems Command, Naval Vessel Register, "Fleet Size," http://www.nvr.navy.mil/NVRSHIPS/FLEETSIZE.HTML (accessed August 15, 2018).

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ships, and 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.

The Navy retired the last of its *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.[56] The LCS concept of operations 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 ships dedicated to a specific mission: ASW, SuW, or MCM.[57]

Planned capability upgrades to give the LCS fleet frigate-like capabilities include "[o]ver-the-horizon surface to surface missile and additional weapon systems and combat system upgrades" and "increased survivability... achieved by incorporating additional self-defense capabilities and increased hardening of vital systems and vital spaces."[58] 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.[59] 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.[60]

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."[61] 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.[62]

The Administration's FY 2019 budget request includes funding for one LCS. Congress authorized the procurement of three LCSs in the FY 2018 NDAA, meeting the LCS requirement for 32 ships. The Navy has stated that the one additional LCS requested in FY 2019 provides sufficient workload, coupled with the 21 LCSs currently under construction or planned, to "allow [two] shipbuilders to maintain stability and be competitive for the FFG(X) award in FY 2020."[63] Both Austal USA and Lockheed Martin disagreed with the Navy's assessment. Austal responded that "funding one LCS in the FY19 budget is not sufficient to support the Shipbuilding Industrial Base" and that "[a]ny reduction in [production] volume would negatively impact the shipbuilding industrial base, including our suppliers (local and national), as well as the ability to efficiently transition to Frigate."[64] Lockheed Martin countered that with its production rate of two LCS per year, "our current production backlog is insufficient to maintain the employment and efficiency levels required for our team to remain competitive for Frigate."[65]

The Navy projects that the LCS deployable force will reach 16 LCSs by the end of FY 2018 and reach 20 ships by the end of FY 2019.[66] This is still well below the fleet size of 71 small surface combatants necessary to fulfill the Navy's global responsibilities, even when combined with the 11 remaining mine countermeasure vessels in the fleet.

In July 2017, the Navy released a Request for Information 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.[67] 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.[68]

The notional FFG(X) procurement plan would purchase 20 ships over 11 years.[69] 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 an existing SSC ship design that can be modified to meet the FFG(X)'s specific capability requirements.[70] 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; Fincantieri/Marinette Marine (F/MM); and General Dynamics/Bath Iron Works (GD/BIW).[71] The Navy will select one shipbuilder in FY 2020.[72]

The Navy possesses 22 *Ticonderoga*-class cruisers.[73] 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 a 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….[74]

In FY 2019, the Navy will continue to execute the "2-4-6" plan on seven of 11 cruisers, with the remaining four BMD-capable cruisers to receive scheduled modernization to their hull and support systems throughout their service life.[75] The Navy currently has six cruisers inducted in the modernization program. Along with the USS *Anzio*, inducted in May 2017, the program includes USS *Cape St. George*, inducted in March 2017; USS *Chosin* and USS *Vicksburg*, inducted in FY 2016; and USS *Cowpens* and USS *Gettysburg*, inducted in FY 2015.[76]

The Navy's FY 2019 budget request includes "$276 million for guided missile cruiser modernization and $79 million to upgrade eight cruisers to AEGIS Baseline 9, enabling them to perform critical Integrated Air and Missile Defense (IAMD) and Ballistic Missile Defense (BMD) operations simultaneously."[77] It also requests $5.6 billion for three DDG 51 Flight III destroyers as part of a 10-ship Multi-Year Procurement (MYP), bringing the class size to 82 ships.[78] 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.

The DDG-1000 *Zumwalt*-class is a "multi-mission destroyer designed with a primary mission of naval surface fire support (NSFS) and operations in littoral (i.e., nearshore) waters."[79] 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."[80] The stealthy DDG-1000 hull design cannot support the required ballistic defense capabilities without significant modifications.

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 better 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).[81] The Navy's FY 2019 budget requests $89.7 million to convert the *Zumwalt*-class destroyers by integrating Raytheon's multi-mission SM-6 anti-air and anti-surface missile, as well as the Maritime Strike variant of the Tomahawk missile.[82]

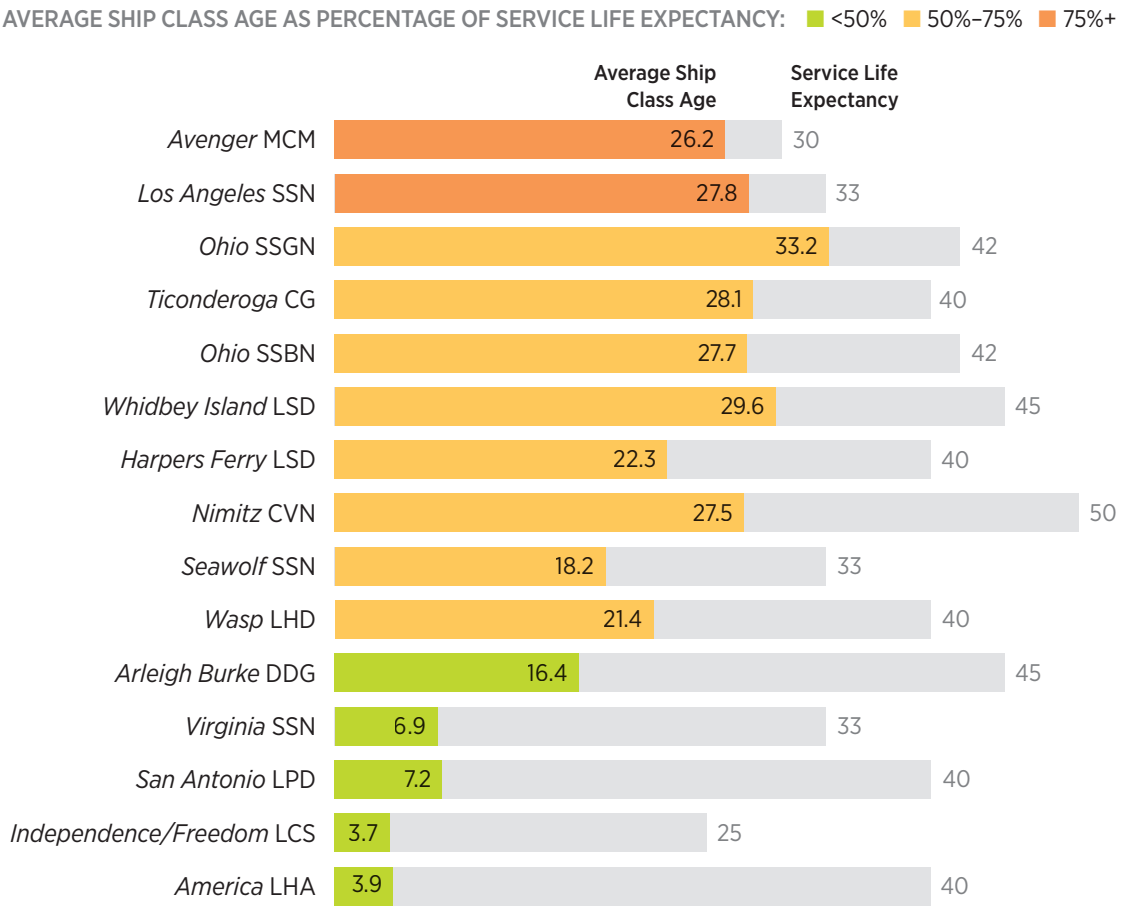
The Navy's 12 landing ships (LSDs), the *Whidbey Island*-class and *Harpers Ferry*-class amphibious vessels, are currently scheduled to reach the end of their 40-year service lives in 2025. The 13-ship LPD-17 Flight II program, previously known as the LX(R) program, will replace these legacy landing 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.[83] Although the first Flight II ship was planned for FY 2020, Congress directed the Navy to accelerate it to FY 2018.[84]

Most of the Navy's battle force fleet consists of legacy platforms. Of the 20 classes of ships in the Navy, only eight are currently in production. For example, 64 percent of the Navy's attack submarines are *Los Angeles*-class submarines, an older platform that is being replaced with a more modern and capable *Virginia*-class.[85]

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 proven to be substantially more expensive to build than the Navy originally estimated.[86] The first ship of any class is typically more expensive than early estimates project, which is

CHART 13

## Combat Fleets Pushing Limits of Life Expectancy




**NOTE:** Average Ship Class Age is as of October 2018.
**SOURCE:** Heritage Foundation research based on data from the U.S. Department of the Navy, U.S. Department of Defense, U.S. Government Publishing Office, and other sources.

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not entirely surprising given the technology assumptions and cost estimates that must be made several years before actual construction begins. Although the CBO has reported that only two of the last 11 lead ships have been delivered over budget, the trend has been downward for the most recent classes.[87] 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.[88]

Many consider the 30-year shipbuilding plan to be optimistic based on recent history. For example, the Navy received $24 billion more in shipbuilding funding than planned yet purchased 50 fewer ships than outlined in the 2007 long-range shipbuilding plan.[89]

The goal of 355 ships stated in the Navy's most recent 30-year plan includes an objective for 12 *Columbia*-class nuclear ballistic missile submarines (SSBNs) to replace the

legacy *Ohio*-class SSBN. Production of these 12 *Columbia*-class submarines will require a significant portion of the Navy's shipbuilding funding if the overall budget is not increased.

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 FY2029–FY2041."[90] This is something that the Navy will continue to have difficulty maintaining as it struggles to sustain, overhaul, modernize, and eventually retire the remainder of its legacy SSBN fleet. The *Columbia*-class SSBN is "the Navy's top priority program"[91] and has been allocated $3 billion—almost 15 percent of its total shipbuilding budget—in the Navy's FY 2019 request for "detail design efforts, continuous missile tube production, and Advanced Construction of major hull components and propulsion systems."[92]

The Navy's long-range strike capability derives from its ability to launch various missiles and combat aircraft. Naval aircraft are much more expensive and difficult to modernize as a class 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.[93] By the end of 2018, all Navy squadrons will have transitioned to more capable and modern F/A-18E/F Super Hornets.[94]

The F/A-18E/F Super Hornet has better range, greater weapons payload, and increased survivability than the F/A-18A-D Legacy Hornet.[95] The Navy is implementing efforts to extend the life of some of the older Super Hornet variants until the F-35C is fully fielded in the mid-2030s, ensuring that the F/A-18E/F "will be the numerically predominant aircraft in CVWs into the mid-late 2030s."[96] The Navy's FY 2019 budget request includes $1.99 billion for 24 F/A-18E/F Super Hornets, and it plans to buy 110 Block III Super Hornets over the next five years in an attempt to mitigate shortfalls in its strike aircraft inventory.[97]

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 will be 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."[98] The FY 2019 budget requests "$147.4 million for research, development, testing, and evaluation (RDT&E) for additional modernization" to ensure that the EA-18G maintains its technical advantage over adversary electronic warfare and air defense systems.[99]

The Navy has been addressing numerous incidents, or physiological episodes (PEs), of dizziness and blackouts by F/A-18 aircrews over the past five years. There were 57 such incidents in 2012 and 114 in 2016, and 52 were reported during the first half of 2017.[100] Of the 588 F/A-18 PE incidents analyzed to date:

> 212 involved ECS [Environmental Control System] component failures, 194 were attributed to breathing gas issues, including 51 OBOGS [Onboard Oxygen Generation System] component failures and 13 breathing gas delivery component failures, 92 involved human factors, and 87 were inconclusive or involved another aircraft system failure.[101]

Only six T-45 training aircraft PEs were reported after the planes returned from an operational pause and modifications to their OBOG system in July 2017, and only one of these PEs has been attributed to the aircraft's breathing systems. The remaining five events "have all been linked to other human factors."[102]

The Navy's Physiological Episode Action Team (PEAT) "considers hypoxia and decompression events [to be] the two most likely causes of recent physiological episodes in aviators," but as physical symptoms related to "pressure fluctuations, hypoxia and contamination overlap, discerning of a root cause is a complex process."[103]

The Navy has implemented numerous corrective actions to address PEs in F/A-18F/F and EA-18G aircraft. These include "new maintenance rules for handling the occurrence of specific ECS built-in test faults;" "revised and expanded emergency procedures;" "forward deployment of transportable recompression systems to immediately treat aircrew in the event they experience pressure related symptoms"; and "annual hypoxia awareness and biennial dynamic training using a Reduced Oxygen Breathing Device (ROBD) to experience and recognize hypoxia symptoms while operating an aircraft simulator."[104] 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 its 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.[105] The F-35 is supposed to be a more capable aircraft relative to the F/A-18, but at planned procurement levels of 260 aircraft, it will not be enough to make up for the Hornets that the Navy will need to replace. The Navy now plans for future carrier air wings to include a combination of both F/A-18E/Fs and F-35Cs. In addition, like the other F-35 variants, the F-35C has faced development problems. The system has been grounded because of engine problems, and software development issues have threatened further delay. The aircraft also has grown more expensive through the development process.

As evidence of continued program issues, in March 2018, the Department of Defense stopped accepting new F-35s "pending resolution of a dispute with [the builder], Lockheed Martin, over who should pay to repair identified issues with corrosion on F-35s." As of April 12, 2018, the delivery of "five aircraft had been deferred."[106] The F-35 program's delay of the Initial Operations Test and Evaluation (IOT&E) until September 2018 appears to be jeopardizing the F-35C's scheduled initial operational capability of February 2018. According to Rear Admiral Dale Horan, Director of Joint Strike Fighter Fleet Integration:

> The whole F-35 enterprise's IOT&E starts in September, so it's not Navy F-35C that's holding up IOC, it's that we're tied to IOT&E and need to see the demonstration and capabilities. We need to really see the 3F capability demonstrated in IOT&E and there's just not going to be enough time to see enough of that before Feb. 2019.[107]

This delay in the F-35C's IOC is not expected to affect the first F-35C operational deployment in 2021.[108]

The Navy is investing in cruise missile modernization and new missile programs to provide increased range, survivability, and effectiveness in modern Anti-Access/Area Denial (A2/AD) environments. The Navy's FY 2019 budget requests $282.4 million in RDT&E and $98.6 million in weapons procurement to develop and procure 112 A2/AD capability upgrades as well as to develop an improved warhead and an anti-ship maritime strike version of the Tactical Tomahawk (TACTOM) Block IV cruise missile.[109] It also requests $143.1 million for development and testing of the Long Range Anti-Ship Missile (LRASM) and $81.2 million to purchase 25 LRASM weapons that will provide the "ability to conduct anti-surface warfare (ASuW) operations against high-value surface combatants protected by Integrated Air Defense Systems with long-range

Surface-to-Air-Missiles and deny adversaries sanctuary of maneuver against 2018–2020 threats."[110] The LRASM is "scheduled to achieve Early Operational Capability on the... Navy F/A-18E/F by the end of FY 2019."[111]

## Readiness

Although the Navy states that it can still deploy forces in accordance with GFMAP requirements, various factors indicate a continued decline in readiness over the past year. Admiral William Moran, Vice Chief of Naval Operations, testified before the Senate Armed Services Readiness Subcommittee in February 2018 that:

> At the height of the Cold War, approximately one in six ships were deployed on any given day, today almost one in three are deployed on any given day.... [N]ational demands for your Navy far exceed its capacity, driving operational tempo [OPTEMPO] to unsustainable levels....
>
> 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.[112]

Over the past nine years, "Continuing Resolutions have averaged 106 days per fiscal year," forcing the Navy to operate under reduced spending levels and severely limiting the ability to complete required ship and aircraft maintenance and training.[113] The FY 2018 Appropriations Act did not become law until March 23, 2018, effectively forcing the Navy to plan and execute 12 months of maintenance and training within the final six months of the fiscal year. "In a six month Continuing Resolution," according to Admiral Moran, "we will delay up to six ship maintenance periods, suffer delays in aircraft maintenance and repair parts, delay our munitions contracts, and...will not award three ship contracts."[114] The cycle of annual continuing resolutions continues to hamper and delay the ability of the U.S. Navy to restore readiness. Admiral John Richardson, Chief of Naval Operations, 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.[115]

The $1.7 billion provided by Congress as part of the FY 2017 Request for Additional Appropriations did help to reverse some of the Navy's "most critical readiness problems by executing 13 more ship maintenance availabilities, restoring 35 additional air frames to flight, and providing 18,000 flying hours to train 900 pilots," all of which "gained back two ship deployments and a combined one year of carrier operations and surge capability."[116]

Like the other services, the Navy has had to dedicate readiness funding to the immediate needs of various engagements around the globe, which means that the maintenance and training for non-deployed ships and sailors are not prioritized. Deferral of ship and aircraft depot maintenance because of inadequate funding or because public shipyards do not have 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 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. Even with the hiring of additional shipyard workers over the

past two years, the public (government-owned) shipyards are still undermanned for the amount of work they need to do.

Correcting these maintenance backlogs will require sufficient and stable funding to defray the costs of ship maintenance and further expand the workforce of 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 2011 and 2016, ship maintenance overruns resulted in the loss of 1,103 aircraft carrier; 6,603 large surface combatant (cruiser and destroyers); and 6,220 submarine operational days.[117] This is the equivalent of losing 0.5 aircraft carriers, 3.0 large surface combatants, and 2.8 submarines from fleet operations for a year.

The FY 2019 budget seeks to increase the public shipyard workforce by 3,187 workers and to provide additional funding to private yards for submarine maintenance in order to lessen the workload on government shipyards.[118] In FY 2019, funding ship maintenance at the maximum executable capacity of both public and private shipyards can address only 96 percent of the required maintenance, and funding aviation maintenance at the maximum executable level of the depots can meet only 92 percent of the requirement.[119] The Navy has commenced a $21 billion, 20-year public shipyard optimization plan to increase shipyard capacity by updating equipment, improving workflow, and modernizing dry docks to accommodate new ship and submarine classes.[120]

Ship and aircraft operations and training are just as critical to fleet readiness as maintenance is. The Navy's FY 2019 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.[121] In addition, flight hours are funded to achieve a T-rating of 2.0 for nine Navy carrier air wings.[122] 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."[123]

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 naval aviation mishaps for F/A-18E/F Super Hornets had increased 108 percent over the past five years, while across the entire aviation fleet, mishaps rose 82 percent. While 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."[124]

The naval aviation community has 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 deploying squadrons had sufficient operational aircraft and personnel operate safely and effectively.[125] 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."[126]

Vice Admiral Troy Shoemaker, Commander, Naval Air Forces, made the operational impact of this aviation readiness decline starkly clear when he testified in November 2017 that "in our Super Hornet community alone, only half of our total inventory of 542 aircraft were flyable, or mission capable, and only 170 or 31% of the total inventory were fully mission capable and ready to 'fight tonight.'"[127]

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.[128] 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. The *Comprehensive 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."[129] The report recommended 58 actions to correct deficiencies across the "Doctrine, Organization, Training, Material, Leadership and Education, Personnel, and Facilities (DOTMLPF)" spectrum.[130]

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 performance and readiness of the fleet.[131] 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."[132]

In short, Navy readiness levels are problematic and will take several years to correct. 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 and fast attack submarines to the extent that they contribute to the overall size of the battle fleet and with 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.

The role of SSBNs (fleet ballistic missile submarines) as one leg of America's nuclear triad capability is well known; perhaps less well known are the day-to-day tasks undertaken by the SSN force, whose operations, which can include collection, surveillance, and support to the special operations community, often take place far from the operations of the surface Navy.

**Two-MRC Requirement.** This *Index* uses the Navy's fleet size required "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." 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 Deployable Carrier Strike Groups.** The average number of aircraft carriers deployed in major U.S. military operations since the end of the Cold War, such as the conflicts in Kuwait in 1991,[133] Afghanistan in 2001,[134] and Iraq in 2003,[135] was between five and seven. An operational fleet of 11 carriers would ensure that five are available to deploy within 30 days for a crisis or conflict. (The rest would be undergoing scheduled maintenance or taking part in training exercises and would not be ready for combat.) Within 90 days, the Navy would generally have seven carriers available.[136] This correlates with the recommendations of numerous force-sizing assessments, from the 1993 Bottom-Up Review (BUR)[137] to the Navy's 2016 Force Structure Assessment,[138] 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 carrier groups and 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.[139]

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:

- "[F]ive to seven air and missile defense–capable large surface combatant ships (guided missile cruiser (CG) or guided missile destroyer (DDG)) to combat the advent of highly capable anti-ship ballistic missiles and anti-ship cruise missiles" and conduct "simultaneous ballistic missile defense and anti-air warfare" operations.

- "A naval integrated fire control-counter air capable cruiser," which "is the preferred ship for the [air and missile defense commander]."

- "No less than three cruise missile land attack capable (e.g. Tomahawk land attack missile or follow on weapon) capable large surface combatant ships."

- "No less than three [surface warfare] cruise missile (e.g. Harpoon or follow-on weapon) capable large surface combatant ships."

- "No less than four multi-functional tactical towed array systems."

- "One fast combat support (T-AOE) or equivalent dry cargo and ammunition (T-AKE) or fleet replenishment oiler (T-AO) pair combat logistics force ship(s)," which, "while not a part of the CSG, are usually assigned to support CSG operations."[140]

Although not mentioned in this instruction, at least one SSN is typically assigned to a CSG.[141]

Therefore, this *Index* defines the nominal CSG engaged in an MRC as follows: one nuclear-powered aircraft carrier (CVN); one carrier air wing (CVW); one CG; four DDGs; two FFGs; two SSNs; and one T-AOE or one T-AO and one T-AKE. Until the new FFG(X) becomes operational, this nominal CSG will consist of six in place of four DDGs.

**Thirteen Carrier Air Wings.** Each carrier deployed for combat operations was equipped with a carrier air wing, meaning that five to six air wings were necessary for each of those four major contingencies listed. The strategic documents differ slightly in this regard because each document suggests one less carrier air wing than the number of aircraft carriers.

A carrier air wing customarily includes four strike fighter squadrons.[142] 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.[143]

**Forty-Five Amphibious Ships.** The 1993 BUR recommended a fleet of 41 large amphibious vessels to support the operations of 2.5 Marine Expeditionary Brigades (MEBs).[144] 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.[145] The number of amphibious vessels required in combat operations has declined since the Korean War, which employed 34 amphibious vessels; 26 were deployed in Vietnam, 21 in the Persian Gulf War, and only seven supported Operation Iraqi Freedom (which did not require as large a sea-based expeditionary force).[146] The Persian Gulf War is the most pertinent example for today because similar vessels were employed, and the modern requirements for an MEB most closely resemble this engagement.[147]

The Marine Corps' *Expeditionary Force 21, Marine Expeditionary Brigade Informational Overview* 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).[148] In conjunction with the Navy's Expeditionary

TABLE 6

## Navy Force Structure Assessment

| Ship Type/Class | Current Fleet | 2016 Force Structure Assessment | *2019 Index* Recommendation |
|---|---|---|---|
| Ballistic Missile Submarines | 14 | 12 | 12 |
| Aircraft Carriers | 11 | 12 | 13 |
| Large Surface Combatants | 90 | 104 | 105 |
| Small Surface Combatants | 24 | 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 | 30 | 39 | 35 |
| **Total** | **284** | **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 August 8, 2018). For more information, see footnote 169.

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Strike Group definition, five ESGs compose one MEB AATF.[149] Based on these requirements and definitions, this *Index* defines the nominal ESG engaged in an MRC as follows: one LHA or LHD; one LPD/LX(R); one LSD; two DDGs; two FFGs; and one T-AOE or one T-AO and one T-AKE. 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,[150] 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 as well as ensuring a strategic reserve of 20 percent.

**Total Ship Requirement.** 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. This analysis did not consider unmanned systems or ship classes that are not current programs of record. While unmanned systems offer the promise to improve the effectiveness and reach of ships and submarines, they have not matured sufficiently to replace a manned ship or submarine in the battle force.

The most significant differences in this updated total ship requirement compared to the Navy's 2016 FSA are in SSC and CLF ships. The

increase in SSC 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 plus the continued requirement for a combination of least 15 MCM ships and MIW LCS. 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."[151] 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 for Navy to assume we would have the resources to aspire to a force of this size with this mix of ships."[152] Finally, this FSA has not been updated to address the 2018 National Defense Strategy, which reestablished long-term strategic competition with China and long-term strategic competition with Russia as the principal Department of Defense priorities.[153]

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 284 ships, planned fleet of 289 ships by the end of FY 2018, 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," down from its *2017 Index* score of "marginal." Depending on the Navy's ability to fund more aggressive growth options and service life extensions as identified in the FY 2019 30-year shipbuilding plan, and in view of the *Columbia*-class ballistic missile submarine program that could cost nearly half of the current shipbuilding budget per hull, the Navy's capacity score could fall further in the "weak" category in the near future.

### Capability Score: Marginal

The overall capability score for the Navy is "marginal," an increase over its score of "weak" in the *2018 Index*. 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 more easily presented in a tabular format as shown in the Appendix.

### Readiness Score: Marginal

The Navy's readiness score remained "marginal." This assessment combines two major elements of naval readiness: the ability to provide 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 it has prioritized restoring readiness through increased maintenance and training in 2017 and 2018, as Admiral Richardson has stated, it will take at least until 2022 for the Navy to restore its readiness to required levels.[154] To improve personnel readiness, the Navy is adding 7,500 sailors in FY 2019 "to address [manpower] gaps at sea."[155]

The Navy has reported that it continues to meet GFMAP goals but at the cost of future readiness. The U.S. Government Accountability Office (GAO) reported in May 2016

that "[t]o meet heavy operational demands over the past decade, the Navy has increased ship deployment lengths and has reduced or deferred ship maintenance"[156] The GAO further found that the Navy's efforts to provide the same amount of forward presence with an undersized fleet have "resulted in declining ship conditions across the fleet" and have "increased the amount of time that ships require to complete maintenance in the shipyards."[157]

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 requirements 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.[158]

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. Navy leadership responded quickly. The Chief of Naval Operations, Admiral Richardson, directed 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."[159]

The Government Accountability Office 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.[160] 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.[161]

Another critical find 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. Recently completed Surface Warfare Officer School seamanship competency checks of 196 first sea tour Officer of the Deck–qualified junior officers revealed that evaluations of almost 84 percent of these officers revealed "some concerns" or "significant concerns."[162]

The readiness reviews presented numerous corrective actions to improve the material condition of its ships as well as the professional training and operational proficiency of its crews. For example:

- Cancellation of all risk-assessment mitigation plans and waivers for expired mission certifications.[163]
- 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.[164]
- Ready for Sea Assessments on Japan-based cruisers and destroyers, with the exception of those completing or in maintenance, in order to rebaseline mission certifications.[165]
- A redesigned Surface Warfare Officer (SWO) career path that increases

professional and seamanship training, adds individual proficiency assessments, and increases at-sea time.[166]

A Readiness Reform Oversight Council to oversee not only implementation of the recommended actions, but also the ongoing impact of these actions to ensure that they achieve their desired results now and in the future.[167]

The Navy's FY 2019 budget request includes $79 million for FY 2019 and $600 million across the FY 2019–FY 2023 Future Years Defense Program "to address training, manning and equipment issues and recommendations identified in the [Comprehensive and Strategic Readiness Reviews]."[168] The Navy's readiness as it pertains to providing global presence is rated as "marginal." The level of COCOM demand for naval presence and the fleet's ability to meet that demand is similar to that found in the *2018 Index* but is 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.

However, the Navy's readiness corrective actions, coupled with an inadequate fleet size, have resulted in a reduction in its ability to respond to COCOM requirements for sustained presence, crisis support, and surge response in the event of a major conflict. Since COCOM demand signals have been 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 OPTEMPO for missions short of major conflict. While 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 ship-driving skills, it will be several years before they can fully change the culture and raise the fleet's overall professional knowledge and experience.

Even with prioritized investments for 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 2019.

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 over one year ago, the gains have not been sufficient to assume that his concerns do not still hold true today.

### Overall U.S. Navy Score: Marginal

The Navy's overall score for the *2018 Index* is "marginal," the same as it was in the *2018 Index*. This was derived by aggregating the scores for capacity ("weak"); capability ("marginal"); and readiness ("marginal"). The Navy's prioritization of restoring readiness and increasing its capacity, matched by increased funding in 2017 and 2018, suggests that its overall score could improve in the near future. Continuation of unstable funding as the result of future continuing resolutions and a return to BCA sequestration-level funding will negate these improvements and instead cause future degradation in the Navy's score.

## 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 2018 ■ Pending

## Aircraft Carrier

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| ***Nimitz*-Class Aircraft Carrier (CVN-68)**<br>Inventory: **10**<br>Fleet age: **27.5** Date: **1975**<br>The expected life of the *Nimitz*-class nuclear aircraft carrier is 50 years. The class will start retiring in the mid-2020s and will be replaced by the *Ford*-class carriers. | 3 | 3 | ***Ford*-Class Aircraft Carrier (CVN-78)**<br>Timeline: **2008–2018**<br>Currently in production, the *Ford*-class will replace the current Nimitz-class aircraft carriers. The *Ford*-class will increase aircraft sorties by 25 percent, require a crew of several hundred fewer sailors, and be able to handle more advanced weapon systems. Program cost increases reflect an increased acquisition objective from 3 to 4 ships.<br>**PROCUREMENT**<br>3 1<br>**SPENDING** *($ millions)*<br>$32,707 $25,932 | 1 | 2 |
| ***Ford*-Class Aircraft Carrier (CVN-21)**<br>Inventory: **1**<br>Fleet age: **1** Date: **2017**<br>The expected life of the *Ford*-class nuclear aircraft carrier is 50 years. | 5 | | | | |

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

# NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

**Procurement and Spending** ■ Through FY 2018 ■ Pending

## Large Surface Combatant

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| ***Ticonderoga*-Class Cruiser (CG-47)**<br>Inventory: **22**<br>Fleet age: **28** Date: **1983**<br>The *Ticonderoga*-class guided missile cruiser has a life expectancy of 40 years. There are plans to lay up half of the cruiser fleet to modernize it and extend its life into the 2030s. There are no replacements currently planned. | 2 | 4 | ***Zumwalt*-Class Destroyer (DDG-1000)**<br>Timeline: **2007–2009**<br>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. The DDG-1000 program was intended to produce a total of 32 ships, but this number has been reduced to 3. The first DDG-1000 was commissioned in October 2016.<br>**PROCUREMENT** 3<br>**SPENDING** *($ millions)* $22,292 $1,200 | 1 | 1 |
| ***Zumwalt*-Class Destroyer**<br>Inventory: **1**<br>Fleet age: **2** Date: **2016**<br>Although the ship has passed sea trials, it continues to experience problems with its combat systems. The second ship of the Zumwalt class is expected to commission in January 2019. | 5 | | | | |
| ***Arleigh Burke*-Class Destroyer (DDG-51)**<br>Inventory: **66**<br>Fleet age: **16.3** Date: **1991**<br>The *Arleigh Burke*-class guided missile destroyer is the only operating class of large surface combatant currently in production. The Navy plans to extend the service life of the entire class to 45 years from its original life expectancy of 35 years. | 3 | | ***Arleigh Burke*-Class Destroyer (DDG-51)**<br>Timeline: **1985–2024**<br>The DDG-51 was restarted in FY 2013 to make up for the reduction in DDG-1000 acquisitions. Future DDG-51s will be upgraded to a Flight III design, which will include the Advanced Missile Defense Radar (AMDR), a more capable missile defense radar. Cost growth reflects a procurement increase to 95 ships.<br>**PROCUREMENT** 80 15<br>**SPENDING** *($ millions)* $90,566 $31,182 | 4 | 4 |

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

# NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

**Procurement and Spending** ■ Through FY 2018 ■ Pending

## Small Surface Combatant

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| **Littoral Combat Ship (LCS)**<br>Inventory: **12**<br>Fleet age: **3.6** Date: **2008**<br>The Littoral Combat Ship includes two classes: the *Independence*-class and the *Freedom*-class, both of which are in the early phases of production. The ship is expected to have a service life of 25 years. The LCS is designed to meet multiple missions and make up the entirety of the small surface combatant requirement. LCS 14 was commissioned in May 2018. | 5 | 2 | **Littoral Combat Ship (LCS)**<br>Timeline: **2009–2025**<br>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. Procurement of 3 additional LCSs in FY2019 will exceed the planned procurement of 32. A new program called the FFG(x) will fill out the remaining 20-ship small surface combatant requirement.<br>**PROCUREMENT** 32<br>**SPENDING** *($ millions)* $21,953 | 2 | 1 |
| ***Avenger*-Class Mine Counter Measure (MCM-1)**<br>Inventory: **11**<br>Fleet age: **26.1** Date: **1987**<br>Designed for mine sweeping and hunting/killing, 11 of the 14 *Avenger*-class ships built are still active. The class has a 30-year life span. The remaining MCMs are expected to be decommissioned throughout the 2020s. There is no replacement in production for this class of ship, but the Navy plans to fill its mine countermeasure role with the LCS. | 1 | | | | |

## SSGN Cruise Missile Submarine

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| ***Ohio*-Class (SSGN-726)**<br>Inventory: **4**<br>Fleet age: **33.1** Date: **1981**<br>Rather than retiring the four oldest *Ohio*-class ballistic missile submarines early, the Navy converted them to SSGN-726 guided missile submarines, equipping them with conventional Tomahawk cruise missiles rather than Trident ballistic missiles tipped with nuclear warheads. The SSGNs provide the Navy with a large stealthy strike capability. The conversion began in 2002 and was completed in 2007. Since the conversion, they are expected to be retired in the late 2020s. The Navy has no planned replacement for the SSGNs once they retire. | 2 | 4 | None | | |

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

## Attack Submarines

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| ***Seawolf*-Class (SSN-21)**<br>Inventory: **3**<br>Fleet age: **18.1** Date: **1997**<br>Larger and equipped with more torpedo tubes than the U.S. Navy's other current nuclear-powered attack submarines, the class was cancelled after three submarines were purchased due to budget constraints in the 1990s. The *Seawolf*-class submarines are expected to be retired by 2030. Meant to replace the *Los Angeles*-class, the *Seawolf* has been replaced by the *Virginia*-class attack submarine. | 3 | | ***Virginia*-Class (SSN-774)**<br>Timeline: **1998–2021**<br>In 2017, the Navy increased the official acquistion objective from 30 to 48.<br>**PROCUREMENT** 28 / 20<br>**SPENDING** *($ millions)* $84,133 / $80,073 | 5 | 4 |
| ***Los Angeles*-Class (SSN-688)**<br>Inventory: **31**<br>Fleet age: **27.2** Date: **1976**<br>The *Los Angeles*-class comprises the largest portion of the Navy's attack submarine fleet. The class has a 33 year service life. Of the 62 built, 28 have been decommissioned and three have been inactivated awaiting decommissioning. The last *Los Angeles*-class submarine is expected to retire in the late 2020s. The *Virginia*-class is replacing this submarine class. | 1 | 4 | | | |
| ***Virginia*-Class (SSN-774)**<br>Inventory: **15**<br>Fleet age: **6.8** Date: **2004**<br>The *Virginia*-class is the U.S. Navy's next-generation attack submarine. The life expectancy of the *Virginia*-class is 33 years. The *Virginia*-class is in production and will replace the *Los Angeles*-class and *Seawolf*-class attack submarines as they are decommissioned. | 4 | | | | |

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

# NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

**Procurement and Spending** ■ Through FY 2018 ■ Pending

## SSBN Ballistic Missile Submarine

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| ***Ohio*-Class (SSBN)**<br>Inventory: **14**<br>Fleet age: **27.6** Date: **1984**<br>The SSBN *Ohio*-class is one of the three legs of the U.S. military's nuclear triad. The *Ohio*-class's expected service life is 42 years. The *Ohio*-class fleet will begin retiring in 2027 at an estimated rate of one submarine per year until 2039. The Navy plans to replace the *Ohio*-class with the SSBN(X) or next-generation "Ohio replacement program." | 2 | 4 | ***Columbia*-Class (SSBN-826)**<br>Inventory: **n/a**<br>Fleet age: **26.7** Date: **1984**<br>In January 2017, the SSBN *Columbia*-class was designated a major defense acquisition program. This also marks the entry of the program into the engineering and manufacturing development phase. The ships will begin construction in FY 2021, and are expected to remain in service until 2080.<br>**PROCUREMENT** 12<br>**SPENDING** *($ millions)* $9,534 $117,340 | 5 | 5 |

## Amphibious Warfare Ship

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| ***Wasp*-Class Amphibious Assault Ship (LHD-1)**<br>Inventory: **8**<br>Fleet age: **21.3** Date: **1989**<br>The *Wasp*-class is the Navy's current amphibious landing helicopter deck, meant to replace the *Tarawa*-class LHA. This ship has a 40-year life span. This class is no longer in production and will be replaced by the new *America*-class. | 3 | 3 | ***America*-class (LHA-6)**<br>Timeline: **2007–2017**<br>The *America*-class is in production with all three LHA-6s already procured. There has been significant cost growth in this program resulting in a Nunn–McCurdy cost breach. The program is also experiencing a 19-month delay because of design problems. One problem was caused by the level of heat from the F-35B STOVL's exhaust. The LHA-7 will follow designs from the LHA-6; FY2017 funded the procurement of the third and final *America*-Class LHA.<br>**PROCUREMENT** 3<br>**SPENDING** *($ millions)* $10,748 $509 | 1 | 1 |
| ***America*-Class Amphibious Assault Ship (LHA-6)**<br>Inventory: **1**<br>Fleet age: **3.8** Date: **2014**<br>The *America*-class, the Navy's new class of large-deck amphibious assault ships, is meant to replace the retiring *Wasp*-class LHDs. The lead ship was delivered in April 2014. The *America*-class is designed to accommodate the Marine Corps's F-35Bs. | 5 | | | | |

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

# NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

**Procurement and Spending** ■ Through FY 2018 ■ Pending

## Amphibious Warfare Ship

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| ***San Antonio*-Class Amphibious Transport Dock (LPD-17)**<br>Inventory: **11**<br>Fleet age: **7.1** Date: **2006**<br>The *San Antonio*-class is the replacement for the *Austin*-class LPD and makes up most of the LPD inventory. The LPDs have well decks that allow the USMC to transfer the vehicles and supplies carried by the ship to the shore via landing craft. The LPD can also carry 4 CH-46s or 2 MV-22s. The class has a 40-year life expectancy. | 5 | 3 | ***San Antonio*-Class Amphibious Transport Dock (LPD-17)**<br>Timeline: **1996–2016**<br>The LPD-17s are replacements for the *San Antonio*-class LPDs. All 13 LPD-17s have been procured.<br>**PROCUREMENT** 13<br>**SPENDING** *($ millions)* $22,464 $195 | 5 | 4 |
| ***Whidbey Island*-Class Dock Landing Ship (LSD-41)**<br>Inventory: **8**<br>Fleet age: **29.5** Date: **1985**<br>The *Whidbey Island*-class is a dock landing ship that transports Marine Corps units, equipment, and supplies for amphibious operations through use of its large stowage and well decks. The *Whidbey Island*-class and *Harpers Ferry*-class ships are to be replaced by LPD–117 Flight II program, which began procurement in FY2018. | 3 | | | | |
| ***Harpers Ferry*-Class Dock Landing Ships (LSD-49)**<br>Inventory: **4**<br>Fleet age: **22.2** Date: **1995**<br>A follow-on to the *Whidbey Island*-class, the *Harpers Ferry*-class LSDs have a larger well deck with more space for vehicle stowage and landing craft. Like the *Whidbey Island*-class, these ships should remain in service until 2038. The *Whidbey Island*-class and *Harpers Ferry*-class ships are planned to be replaced by the LPD–17 Flight II, which began procurement in FY2018. | 3 | | **LPD-17 Flight II**<br>Timeline: **2018–TBD**<br>Previously known as LX(R), the LPD–17 Flight II program will procure 13 ships to replace the Navy's LSD-type ships. The Navy originally planned to procure the first Flight II ships in 2020, however accelerated procurement funding enabled procurement of the first LPD-17 Flight II in 2018. A procurement timeline remains in development.<br>**PROCUREMENT** 1 12<br>**SPENDING** *($ millions)* $1,800 | 5 | 5 |

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

# NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

**Procurement and Spending** ■ Through FY 2018 ■ Pending

## Airborne Early Warning

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| **E-2C Hawkeye**<br>Inventory: **50**<br>Fleet age: **32** Date: **1964**<br>The E-2C Hawkeye is a battle management and airborne early warning aircraft. While still operational, the E-2C is nearing the end of its service life and is being replaced by the E-2D Advanced Hawkeye. The E-2C fleet received a series of upgrades to mechanical and computer systems around the year 2000. | 1 | 4 | **E-2D Advanced Hawkeye**<br>Timeline: **2009–2024**<br>Meant to replace the E-2C, the E-2D Hawkeye is in production. The original plan was to purchase five per year until 2023.<br>**PROCUREMENT** 51 / 24<br>**SPENDING** *($ millions)* $14,805 / $6,652 | 5 | 4 |
| **E-2D Advanced Hawkeye**<br>Inventory: **30**<br>Fleet age: **3** Date: **2013**<br>A more advanced version of the E-2C, the E-2D provides improved battle management capabilities. | 5 | | | | |

## Electronic Attack Aircraft

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| **EA-18G Growler**<br>Inventory: **131**<br>Fleet age: **4** Date: **2010**<br>The EA-18G electronic warfare aircraft replaced the legacy EA-6B Prowlers. The platform is still in production and is relatively new. | 5 | 5 | **EA-18G Growler**<br>Timeline: **2006–2016**<br>The EA-18G Growler has been in production for several years, with few current acquisition problems. The program total of 160 is an increase from previous years, which estimated the Navy would purchase 88. All 160 have been procured.<br>**PROCUREMENT** 160<br>**SPENDING** *($ millions)* $15,031 / $377 | 5 | 4 |

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

# NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

**Procurement and Spending** ■ Through FY 2018 ■ Pending

## Fighter/Attack Aircraft

| PLATFORM | Age Score | Capability Score | MODERNIZATION PROGRAM | Size Score | Health Score |
|---|---|---|---|---|---|
| **F/A-18 A-D Hornet**<br>Inventory: **139**<br>Fleet age: **25.5** Date: **1983**<br>The F/A-18 is the Navy's older carrier-based fighter and strike attack aircraft. The Navy has been trying to extend the life of the later variants (C-D) from 6,000 flight hours to potentially 10,000. In 2019, the Navy plans to transfer its remaining F/A–18 A–Ds to the Marine Corps to help maintain its fleet through 2030. | 1 | 3 | **F-35C Joint Strike Fighter**<br>Timeline: **2009–2033**<br>The F-35C is the Navy's variant of the Joint Strike Fighter. The Joint Strike Fighter faced many issues during its developmental stages, including engine problems, software development delays, cost overruns incurring a Nunn–McCurdy breach, and structural problems. The F-35C variant was always scheduled to be the last one to reach IOC, which repeatedly has been and is currently planned for 2019.<br>**PROCUREMENT** 75 185<br>**SPENDING** *($ millions)* $133,099 $273,122 | 1 | 1 |
| **F/A-18 E/F Super Hornet**<br>Inventory: **561**<br>Fleet age: **15** Date: **2001**<br>The F/A-18 E/F Super Hornet is a newer, more capable version of the Hornet. The Navy is aiming to have a combination of Super Hornets and F-35Cs make up their carrier-based strike capability. The F/A-18E-F has an expected service life of 20 years. | 2 | | | | |

**NOTES:** 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.
**SOURCE:** Heritage Foundation research using data from government documents and websites. See also Dakota L. Wood, ed., *2018 Index of U.S. Military Strength* (Washington, DC: The Heritage Foundation, 2018), http://index.heritage.org/militarystrength/.

See Methodology for descriptions of scores. Fleet age—Average age of fleet Date—Year fleet first entered service

## Endnotes

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131. U.S. Department of the Navy, *Strategic Readiness Review 2017*, http://s3.amazonaws.com/CHINFO/SRR+Final+12112017.pdf (accessed August 11, 2018).
132. Ibid., pp. 4–5.
133. U.S. Navy, Naval History and Heritage Command, "Naval Aviation Units Involved in the Persian Gulf War (16 January–27 February 1991)," July 8, 2014, https://www.history.navy.mil/research/histories/naval-aviation-history/involvement-by-conflict/gulf-war-carrier-deployments.html (accessed August 11, 2018).
134. Gregory Bereiter, "The US Navy in Operation Enduring Freedom, 2001–2002," U.S. Navy, Naval History and Heritage Command, August 18, 2017, https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/u/us-navy-operation-enduring-freedom-2001-2002.html (accessed August 11, 2018).
135. U.S. Navy, Naval History and Heritage Command, "Operation Iraqi Freedom," November 6, 2017, https://www.history.navy.mil/browse-by-topic/wars-conflicts-and-operations/terrorism/operation-iraqi-freedom.html (accessed August 11, 2018).
136. Congressional Budget Office, *The U.S. Military's Force Structure: A Primer*, July 2016, p. 53, https://www.cbo.gov/publication/51535 (accessed August 11, 2018).
137. 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.

138. 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.

139. The Navy's Optimized Fleet Response Plan dictates a 36-month cycle of maintenance, training, and forward deployment. The OFRP allows for six months of shipyard maintenance, eight months of basic and integrated training, and a seven-month deployment followed by a 15-month sustainment period in which the CSG will be at its homeport but maintaining a deployed-force level of proficiency. If we assume that the carrier and its escort ships are not available during their maintenance cycle for even a 30-day surge, this equates to just over 19 percent unavailability in the 36-month cycle. The seven-month deployment per each cycle also equates to five CVNs required for a 1.0 continuous CVN presence.

140. U.S. Department of the Navy, Office of the Chief of Naval Operations, "Force Composition of Afloat Navy and Naval Groups," OPNAV INSTRUCTION 3501,316C, November 10, 2017, Enclosure (1), "Carrier Strike Group," p. 2, https://doni.documentservices.dla.mil/Directives/03000%20Naval%20Operations%20and%20Readiness/03-500%20Training%20and%20Readiness%20Services/3501.316C.pdf (accessed August 15, 2018).

141. Table 1.1, "Notional Configuration for a Carrier Battle Group," in U.S. General Accounting Office, *Navy Carrier Battle Groups: The Structure and Affordability of the Future Force*, GAO/NSIAD-93-94, February 1993, p. 18, https://www.gao.gov/assets/160/152948.pdf (accessed August 11, 2018).

142. U.S. Navy, "The Carrier Air Wing," http://www.navy.mil/navydata/ships/carriers/powerhouse/airwing.asp (accessed July 5, 2018).

143. The full array of aircraft comprising a carrier air wing also includes one EA-18G Growler electronic attack squadron, one E-2D Hawkeye airborne early warning squadron, two SH-60 Seahawk helicopter squadrons, and one C-2 Greyhound logistics support squadron.

144. Table E-1, "Comparison of Navy's 355-Ship Goal, 346-Ship Navy Goal from 1993 BUR, and 346-Ship Navy Goal from 2010 QDR Review Panel," in O'Rourke, "Navy Force Structure and Shipbuilding Plans," p. 62.

145. U.S. Navy, "Executive Summary: 2016 Navy Force Structure Assessment (FSA)," p. 1.

146. The size and capability of amphibious ships also have grown over time, with smaller amphibious ships like the old landing ship tank (LST) replaced by the much larger LSD and LPD classes. Consequently, fewer ships are required to lift the same or an even larger amphibious force.

147. U.S. Marine Corps, Concepts and Programs, "Types of MAGTFs," http://www.candp.marines.mil/Organization/MAGTF/Types-of-MAGTFs/ (accessed August 18, 2018). See especially the included graphic, "Notional Laydown of a Marine Expeditionary Brigade (MEB)."

148. Ibid.

149. The Navy's "Force Composition of Afloat Navy and Naval Groups" 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 "[at] least one amphibious dock landing ship (LSD)." "[O]ther 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," OPNAVINST 3501.316C, Enclosure (2), "Amphibious Ready Group and Marine Expeditionary Unit," p. 1, and Enclosure (3), "Expeditionary Strike Group," p. 1.

150. Congressional Budget Office, *An Analysis of the Navy's Amphibious Warfare Ships for Deploying Marines Overseas*, November 2011, p. 1, http://www.cbo.gov/sites/default/files/cbofiles/attachments/11-18-AmphibiousShips.pdf (accessed July 5, 2018).

151. U.S. Navy, "Executive Summary: 2016 Navy Force Structure Assessment (FSA)," p. 3.

152. Ibid., p. 2.

153. Mattis, *Summary of the 2018 National Defense Strategy*, p. 4.

154. Congressional Quarterly, "Senate Armed Services Committee Holds Hearing on Navy Posture," April 19, 2018.

155. Vice Admiral Luke M. McCollum, Chief of Navy Reserve, Commander, Navy Reserve Force; Vice Admiral William K. Lescher, Deputy Chief of Naval Operations for Integration of Capabilities and Resources; and Vice Admiral Andrew L. Lewis, Deputy Chief of Naval Operations for Operations, Plans and Strategy, statement on "U.S. Navy Readiness" before the Subcommittee on Readiness of the House Committee on Armed Services, U.S. House of Representatives, March 20, 2018, p. 6, https://docs.house.gov/meetings/AS/AS03/20180320/108020/HHRG-115-AS03-Wstate-LescherW-20180320.pdf (accessed August 12, 2018).

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157. Ibid., p. 8.
158. Stenographic transcript of *Hearing to Receive Testimony on the Current Readiness of U.S. Forces*, Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate, February 8, 2016, pp. 44–45, https://www.armed-services.senate.gov/imo/media/doc/17-07_02-08-17.pdf (accessed August 12, 2018).
159. Hope Hodge Seck, "CNO Orders Operational Pause, Review After Latest Ship Collision," Military.com, August 21, 2017, https://www.military.com/daily-news/2017/08/21/cno-orders-operational-pause-review-after-latest-ship-collision.html (accessed August 11, 2018).
160. Pendleton, "Navy Readiness: Actions Needed to Address Persistent Maintenance, Training, and Other Challenges Affecting the Fleet," p. 8, https://www.gao.gov/assets/690/687224.pdf (accessed July 5, 2018).
161. Ibid.
162. David B. Larter, "Troubling US Navy Review Finds Widespread Shortfalls in Basic Seamanship," *Defense News*, June 6, 2018, https://www.defensenews.com/naval/2018/06/06/troubling-us-navy-review-finds-widespread-shortfalls-in-basic-seamanship/ (accessed August 11, 2018).
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165. Department of the Navy, Admiral John Richardson, Chief of Naval Operations, statement on "Surface Warfare at a Crossroads" before the Subcommittee on Readiness and Subcommittee on Seapower and Projection Forces, Committee on Armed Services, U.S. House of Representatives, January 18, 2018, p. 2, https://docs.house.gov/meetings/AS/AS03/20180118/106784/HHRG-115-AS03-Wstate-RichardsonJ-20180118.pdf (accessed August 12, 2018).
166. Commander, Naval Surface Forces (COMNAVSURFOR), message on "Surface Warfare Officer Career Path and Training Continuum," June 15, 2018, https://news.usni.org/2018/06/28/new-career-path-surface-warfare-officers-stresses-fundamentals-training-first-ship-time-sea (accessed August 12, 2018).
167. Navy News Service, "Navy Stands Up Readiness Reform and Oversight Council," February 2, 2018, http://www.navy.mil/submit/display.asp?story_id=104212 (accessed August 12, 2018).
168. McCollum, Lescher, and Lewis, statement on "U.S. Navy Readiness," March 20, 2018, p. 8.
169. "Current Fleet" numbers taken from the Naval Vessel Registry as of July 16, 2018. U.S. Department of the Navy recommendations come from the 2016 Navy Force Structure Assessment. 12 Columbia-class nuclear-powered ballistic missile submarines (SSBN) can provide the same at-sea presence requirements as 14 Ohio-class SSBNs due to condensed timelines for midlife maintenance overhauls. Numbers for large surface combatants include guided missile destroyers (DDG) and guided missile cruisers (CG). Large surface combatant requirement driven by carrier strike group (CSG), expeditionary strike group (ESG), and ballistic missile defense (BMD) requirements. Numbers for small surface combatants include littoral combat ships (LCS), guided missile frigates (FFG), and mine countermeasure ships (MCM). Nuclear-powered guided missile submarines (SSGNs) were not considered in recommended force structure, since all SSGNS will be retired by 2028 and the soonest the Navy could field a replacement would be approximately 2040. *2019 Index* recommendation of 45 large deck amphibious ships represents a minimum requirement. New Marine Corps requirements for distributed expeditionary operations could demand additional smaller/non-traditional amphibious support ships. If the current fleet of single mission fleet oilers (T-AO) and dry cargo/ammunition ships (T-AKE) in the Navy's combat logistics force were replaced by a more capable class of logistics ships, this number could be reduced. Command and support ships include amphibious command ships (LCC), expeditionary fast transport ships (EPF), expeditionary mobile base ships (ESB), expeditionary transfer dock (ESD), submarine tenders (AS), ocean surveillance ships (T-AGOS), and salvage and submarine rescue mission support (T-ATS).