

U.S. Navy

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The Navy's enacted budget for fiscal year (FY) 2021 was \$162.9 billion. The goal was to balance readiness, lethality, and capacity so that the Navy could be “agile and ready to fight today while also committing to the training, maintenance, and modernization to ensure [that it] can fight and win tomorrow.”¹ The proposed FY 2022 Navy budget is \$163.9 billion for an overall increase of 1 percent.²

The budget themes for the Department of the Navy (which includes both the U.S. Navy and the U.S. Marine Corps) under the Biden Administration are “Defend the Nation” (to include “rapid innovation”); “Take Care of Our People” (to include “building resilience and readiness”); and “Succeed through Teamwork.”³ Unfortunately, the Navy is under immense strain to maintain readiness for combat while also conducting the daily operations necessary in peacetime to compete with the activities of China and Russia.

In the year since publication of the *2021 Index of U.S. Military Strength*, there have been several significant developments that are important to the Navy.

- COVID-19 vaccines have been approved, enabling officers and sailors to be vaccinated at higher rates relative to the national average.
- In late April 2021, the Navy conducted its first multi-platform manned-unmanned fleet experiment, Integrated Battle Problem 21 (UxS IBP21).
- Highlighting the importance of maritime choke points to national security, on March 23, 2021, container ship *Ever Given* ran aground in the Suez Canal and stopped the flow of maritime traffic through the canal for 11 days, delaying transit of the *Eisenhower* Carrier Strike Group.⁴
- Because of a catastrophic fire in mid-July 2020, USS *Bonhomme Richard* (LHA-6) was decommissioned just halfway through its planned service life.

Strategic Framework. The Navy, Marine Corps, and Coast Guard (known collectively as the sea services) have enabled the U.S. to project power across the oceans, controlling activities on the seas when and where needed. To address today's maritime competition more effectively, the sea services have released a new naval strategy, *Advantage at Sea*. If the new strategy is executed, the Navy will be conducting more assertive forward presence operations to challenge Chinese and Russian maritime coercion.⁵

As the U.S. military's primary maritime arm, the Navy will provide the enduring forward global presence required of this strategy while retaining war-winning forces. The Navy therefore continues to focus its investments in several functional areas: power projection, control of the seas, maritime security, strategic deterrence, and domain access. This approach is informed by several key documents:

- The 2021 Interim National Security Strategic Guidance;⁶
- The December 2020 Advantage at Sea naval strategy;⁷
- The 2018 National Defense Strategy (NDS);⁸ and
- The Global Force Management Allocation Plan (GFMAP).⁹

U.S. official strategic guidance increasingly requires the Navy to act beyond the demands of conventional warfighting. China and Russia use their fleets to establish a physical presence in regions that are important to their economic and security interests in order to influence the policies of other countries. To counter their influence, the U.S. Navy similarly sails ships in these waters to reassure allies of U.S. commitments and to signal to competitors that they do not have a free hand to impose their will. This means that the Navy must balance two key missions: ensuring that it has a fleet ready for war while also using that fleet for peacetime “presence” operations. Both missions require crews and ships that are materially ready for action and a fleet that is large enough to maintain presence and marshal enough combat power to win in battle.

This *Index* focuses on the following elements as the primary criteria by which to measure U.S. naval strength:

- Sufficient **capacity** to defeat enemies in major combat operations and provide a credible peacetime forward presence to maintain freedom of shipping lanes and deter aggression;
- Sufficient technical **capability** to ensure that the Navy is able to defeat potential adversaries; and
- Sufficient **readiness** to ensure that the fleet can “fight tonight” given proper material maintenance, personnel training, and physical well-being.

Capacity

Force Structure. The Navy is unique relative to the other services in that its capacity requirements must meet two separate objectives:

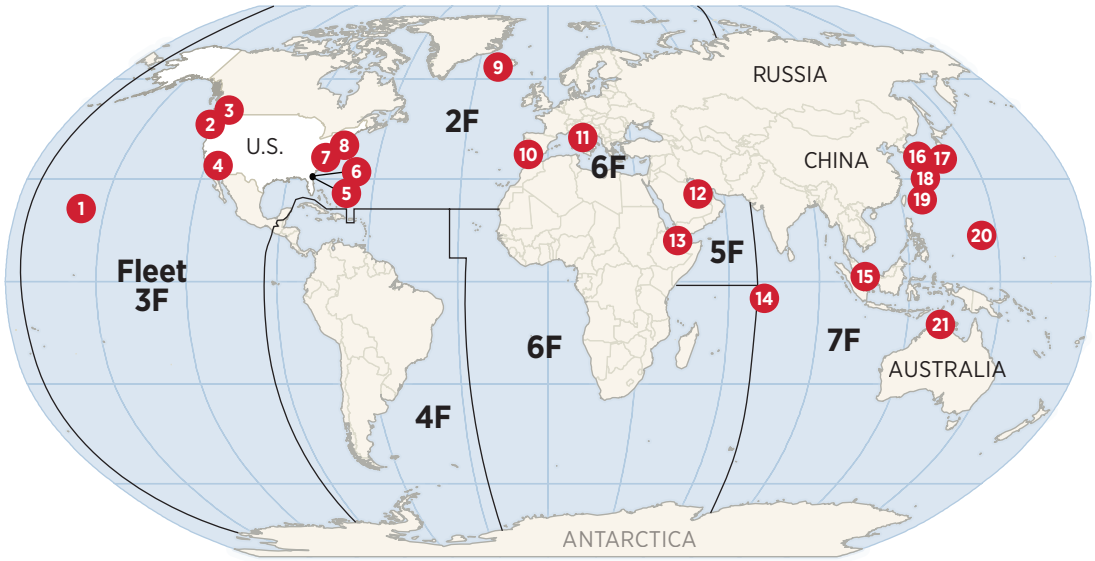
1. During peacetime, the Navy must maintain a global presence in distant regions both to deter potential aggressors and to assure allies and security partners.
2. The Navy must be able to win wars. To this end, the Navy measures capacity by the size of its battle force, which is composed of ships it considers directly connected to combat missions.¹⁰

This *Index* continues the benchmark set in the *2019 Index*: 400 ships to ensure the capability to fight two major regional contingencies (MRCs) simultaneously or nearly simultaneously, plus a 20 percent strategic reserve, and historical levels of 100 ships forward deployed in peacetime.¹¹ This 400-ship fleet is centered on providing:

- 13 Carrier Strike Groups (CSGs);
- 13 carrier air wings with a minimum of 624 strike fighter aircraft;¹² and
- 15 Expeditionary Strike Groups (ESGs).¹³

Unmanned platforms are not included because they have not matured as a practical asset. They hold great potential and will likely be a significant capability, but until they are developed and fielded in larger numbers, their impact on the Navy’s warfighting potential remains speculative. The same holds true across the fleet when it comes to new classes of ships. The Navy is investing in research, modeling, war gaming, and intellectual exercises to improve its understanding of the potential utility of new ship and fleet designs. Consequently, this *Index* measures what is known and can be known in naval affairs, assessing the current Navy’s size, modernity, and readiness to perform its most important missions today.

Key U.S. Naval Installations



- 1** Joint Base Pearl Harbor-Hickham, HI
U.S. Pacific Fleet headquarters
- 2** Naval Base Kitsap, WA
- 3** Naval Station Everett, WA
- 4** Naval Base San Diego and Naval Base Coronado, CA
U.S. Third Fleet headquarters
- 5** Naval Station Mayport, FL
U.S. Fourth Fleet headquarters
- 6** Naval Submarine Base King’s Bay, GA
- 7** Naval Base Norfolk and Joint Expeditionary Base Little Creek, VA
U.S. Fleet Forces Command and U.S. Second Fleet headquarters
- 8** Naval Submarine Base New London, CT
- 9** Keflavik, Iceland—Expeditionary Maritime Operations Center
- 10** Naval Station Rota, Spain
- 11** Naval Support Activity Gaeta, Italy
U.S. Sixth Fleet headquarters
- 12** Naval Support Activity, Bahrain
U.S. Fifth Fleet headquarters
- 13** Lemonnier, Djibouti—Camp Lemonnier
- 14** Diego Garcia—Navy Support Facility Diego Garcia
- 15** Singapore—Commander Logistics Group Western Pacific
- 16** Buson, South Korea—Fleet Activities Chinhae Navy Base
- 17** U.S. Fleet Activity Yokosuka, Japan
U.S. Seventh Fleet headquarters
- 18** U.S. Fleet Activity Sasebo, Japan
- 19** Okinawa, Japan—Naval Base White Beach
- 20** Naval Base Guam—Navy Expeditionary Force Command Pacific headquarters
- 21** Darwin, Australia—Marine Rotational Force Darwin

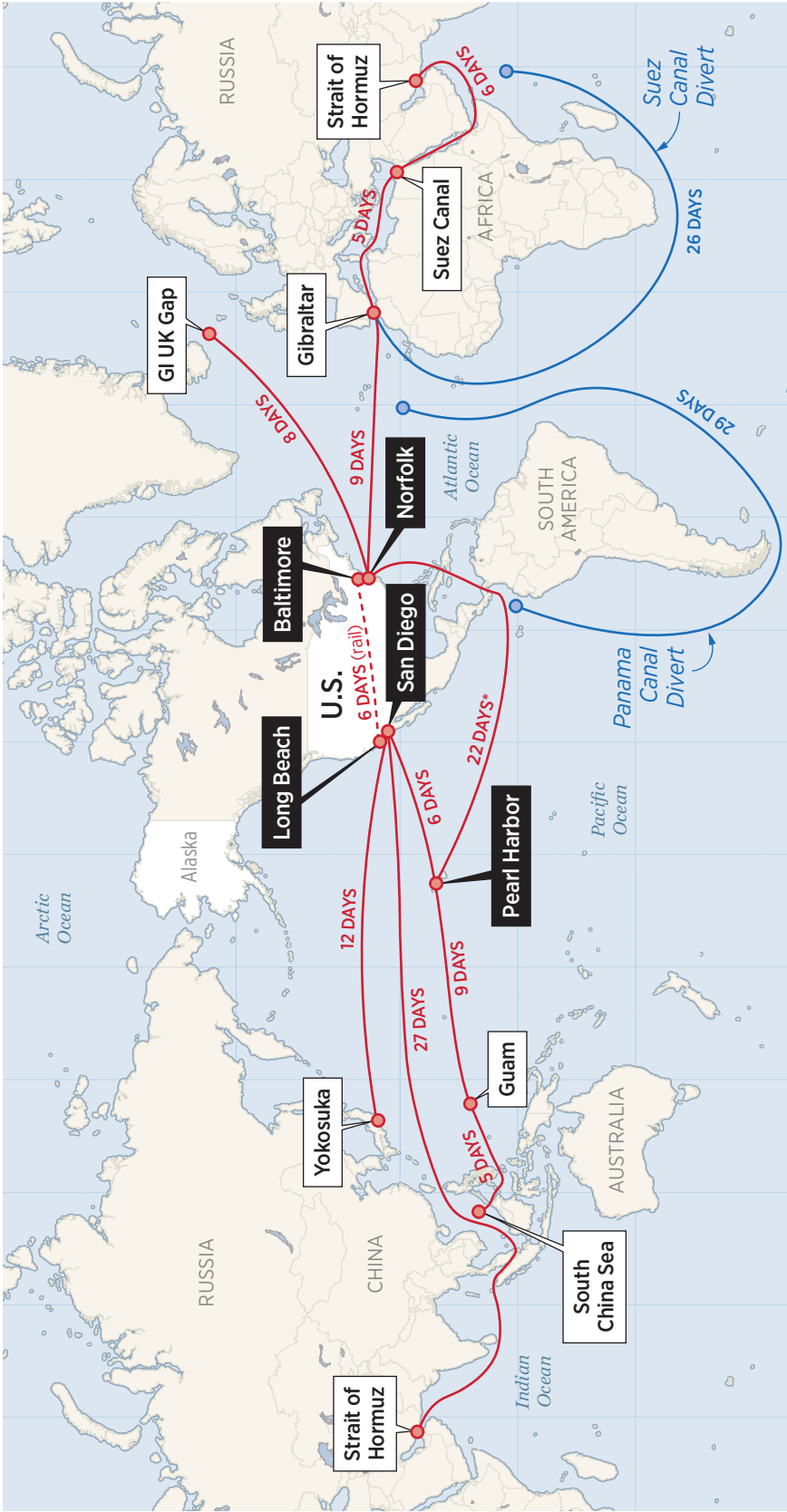
NOTE: Fleet boundaries are approximate.

SOURCE: Heritage Foundation research.

 heritage.org

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

Steaming times are approximate based on an average speed of 15 knots.



* Assumes no delay in passage through the Panama Canal.

SOURCE: Heritage Foundation research.

Relative to the above metric, the Navy's current fleet of 297 warships is inadequate and places greater strain on the ability of ships and crews to meet existing operational requirements. To alleviate the operational stress on an undersized fleet, the Navy has attempted since 2016 to build a larger fleet. However, for myriad reasons, it has been unable to achieve sustained growth. In the past, the Navy has had some success in meeting operational requirements with fewer ships by posturing ships forward as it has done in Rota, Spain, and Guam.

Posture/Presence. Although the Navy remains committed to sustaining forward presence, it has struggled to meet the requests of regional Combatant Commanders. The result has been longer and more frequent deployments to meet a historical steady-state forward presence of 100 warships.¹⁴ At the height of the Cold War in 1985, the percentage of the 571-ship fleet deployed was less than 15 percent, and throughout the 1990s, deployments seldom exceeded the six-month norm: Only 4 percent to 7 percent of the fleet exceeded six-month deployments on an annual basis.¹⁵ Using the Navy's aircraft carrier fleet—the most taxed platform—as a sample set, for 20 years, approximately 25 percent of the aircraft carrier fleet has been deployed. Following the 2017 deadly collisions involving USS *McCain* and USS *Fitzgerald*, this dropped temporarily to less than 20 percent, but it surged again to almost 30 percent in 2020.¹⁶

The numbers as of July 12, 2021, are fairly typical for a total battle force of 297 deployable ships with 83 warships at sea: 58 deployed and underway and 25 underway on local operations for an operational tempo (OPTEMPO) of 28 percent, nearly double the OPTEMPO that characterized the Cold War.¹⁷ Given Combatant Commanders' requirements for naval presence, there is impetus to have as many ships forward deployed as possible by:

- **Homeporting.** The ships, crew, and their families are stationed at the port or based abroad (e.g., a CSG in Yokosuka, Japan).

- **Forward Stationing.** Only the ships are based abroad while crews are rotated out to the ship.¹⁸ This deployment model is currently used for Littoral Combat Ships (LCS) and *Ohio*-class guided missile submarines (SSGNs) manned with rotating blue and gold crews, effectively doubling the normal forward deployment time (e.g., LCS in Singapore).

These options allow one forward-based ship to provide a greater level of presence than four ships based in the continental United States (CONUS) can provide by offsetting the time needed to transit ships to and familiarize their crews with distant theaters.¹⁹ This is captured in the Navy's GFM planning assumptions: 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.²⁰ To date, the Navy's use of homeporting and forward stationing has not mitigated the reduction in overall fleet size on forward presence.

Shipbuilding Capacity. To meet stated fleet-size goals, the Navy must build and maintain ships. Significant shortfalls in shipyards, both government and commercial, make both of these tasks hard to accomplish, and underfunded defense budgets make accomplishing them even more difficult. Given the limited ability to build ships, the Navy will struggle to meet the congressionally mandated 355-ship goal,²¹ much less the 400 ships called for in this *Index*.

A bright spot in FY 2020 was the Navy's procurement of 12 ships, which marked a high point in shipbuilding over the past 20 years.²² However, subsequent procurement has not kept pace. The Navy purchased 10 new warships in FY 2021 and will purchase another eight in FY 2022,²³ but it will not meet congressional mandates for a fleet of 12 aircraft carriers.²⁴ Instead, the aircraft carrier fleet could shrink to nine (possibly augmented by a light carrier yet to be defined).²⁵

Meanwhile, diminished demand for ships has led shipbuilders to divest workforce and

delay capital investments. From 2005 to 2020, the Navy's procurement of new warships increased the size of the fleet from 291 to 296 warships; at the same time, China's navy grew from 216 to 360 warships.²⁶ If the Navy is to build a larger fleet, more shipbuilders will have to be hired and trained—a lengthy process that precedes any expansion of the fleet. Sadly, labor statistics from 2017 to 2020 show trends in the opposite direction with total shipbuilding labor involved in production, like welders and pipefitters, shrinking 3 percent for a loss of 1,950 workers and wages falling relative to inflation.²⁷ The consequence is a reduction in the shipbuilding sector's capacity to meet emergent demands from the Navy.

Of particular concern is the increased production of nuclear-powered warships, most notably nuclear-powered submarines that would be vital in any conflict with China. Limited nuclear shipbuilding capacity²⁸ may constrain the Navy's plans to increase the build rate from two attack submarines to three while concurrently building one ballistic missile submarine.²⁹ To support a larger nuclear-powered fleet, the relevant public shipyards have increased their workforce by 16 percent since 2013.³⁰ However, as demand increases for nuclear-powered warships to pace the threat from China and Russia into the foreseeable future, it remains to be seen whether the public shipyards will be able to sustain the recruitment of skilled labor in the numbers needed.

As it stands today, the most senior naval officer, the Chief of Naval Operations (CNO), has admitted that current funding will not build or maintain the larger fleet that both the Navy and this *Index* say is needed and Congress has mandated. At best, the Navy has assessed that it will only be able to maintain a fleet of “about 300 to 305 ships.”³¹

Manpower. In 2018, the Navy assessed that its manpower would need to grow by approximately 35,000 to achieve an end strength of 360,395 sailors to support a 355-ship Navy;³² for comparison, the last time the Navy had a similar number of ships was in 1997, when it had 359 ships and 398,847 officers and

sailors.³³ As of June 10, 2021, the Navy consisted of 342,911 officers and sailors, 17,484 short of the number needed by 2034.³⁴ To improve personnel readiness and meet the demands of a growing fleet, the Navy added 5,100 sailors in FY 2020.³⁵ The FY 2021 budget continued these increases in active-duty manning end strength by an additional 7,300 sailors.³⁶ The Navy recently exceeded retention and recruitment goals for FY 2020 and appears to be on track to meet its FY 2021 recruitment goals. It remains to be seen, however, whether high retention and recruitment rates can be sustained to meet long-range manning needs.

Despite the acknowledged need to increase the Navy's cadre of officers and enlisted sailors, the President's FY 2022 budget goes in the opposite direction for the first time in years. This proposed budget reduces the Navy's end strength by 1,600 officers and sailors in the Active component and 200 in the reserves while increasing the civilian workforce by 1,141 full-time employees.³⁷ Moreover, under the theme of “Take Care of Our People,” it shrinks higher education funding by \$117 million and other “key educational programs” such as the Reserve Officer Training Corps (ROTC) by another \$4 million.³⁸ Such reductions are surprising in view of the Government Accountability Office's recent findings that persistent crew manning shortfalls on ships are as high as 15 percent and compound crew fatigue, which was a contributing factor in several fatal collisions in 2017.³⁹

Finally, the effort to attract people to join the Navy is made more difficult by wages that are not keeping up with civilian wages. It is therefore not helpful that a 2.7 percent pay raise is planned in FY 2022 at a time when inflation continues to increase: On August 11, 2021, the U.S. Bureau of Labor Statistics reported that “[t]he all items index rose 5.4 percent for the 12 months ending July, the same increase as the period ending July.”⁴⁰

Capability

A complete measure of naval capabilities requires an assessment of U.S. platforms against enemy weapons in plausible scenarios. The

TABLE 4

Navy Fleet Design

	Starting Point	Recommendation			Navy Plan (Dec. 2020)		Range per Future Naval Force Study
	Jan. 2021	2023	2028	2035	2023	2035	
Unmanned (LUSV, MUSV, XLUUV)	0	9	48	136	2	110	143 to 242
Aircraft Carriers (CVN, CVNE, CVS)	11	11	12	15	11	11	8 to 17
Large Surface Combatant	91	103	111	94	92	86	73 to 88
Small Surface Combatant	30	32	38	56	37	58	60 to 67
Logistics and Support Vessels	63	71	98	135	70	96	96 to 117
Submarines (SSBN, SSGN, SSN)	68	78	77	82	72	74	84 to 90
Amphibious Warships	33	34	42	57	28	52	61 to 67
Total Without Unmanned	296	329	378	439	310	377	382 to 446
Total	296	338	426	575	312	487	525 to 688

SOURCES: U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities–OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF (accessed August 19, 2021), and Heritage Foundation research.

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Navy routinely conducts war games, exercises, and simulations to assess this, but insight into its assessments is limited by their classified nature. This *Index* therefore assesses capability based on remaining hull life, mission effectiveness, payloads, and the feasibility of maintaining the platform’s technological edge.

Most of the Navy’s fleet consists of older platforms; of the Navy’s 20 classes of ships, only eight are in production. However, across the Department of the Navy’s \$211.7 billion FY 2022 budget,⁴¹ investment in future capability will see the largest real dollar increase (\$2.5 billion) and relative increase (12.4 percent) over the previous year.⁴² The following are highlights by platform.

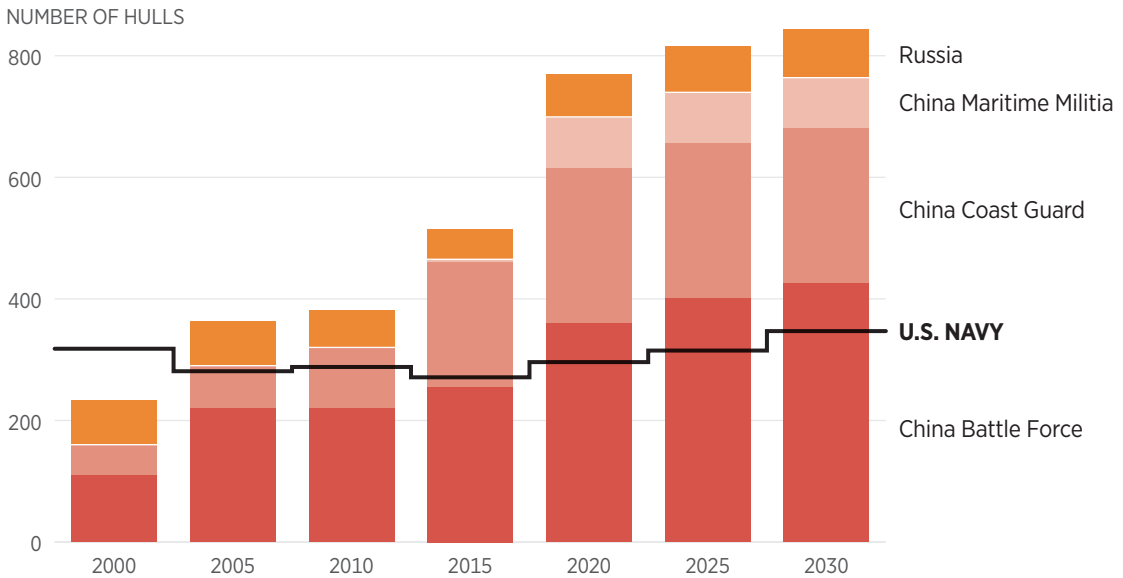
Ballistic Missile Submarines (SSBN).

The *Columbia*-class will relieve the aging *Ohio*-class SSBN fleet. Because of the implications of this for the nation’s strategic nuclear

deterrence, the *Columbia*-class SSBN remains the Navy’s top acquisition priority. To ensure the continuity of this leg of the U.S. nuclear triad, the first *Columbia*-class SSBN must be delivered on time for its first deterrent patrol in 2031.⁴³ To achieve this goal, the Navy signed a \$9.47 billion contract in November 2020 with General Dynamics Electric Boat for the first in-class boat and advanced procurement for long-lead-time components of the second hull.⁴⁴

Nuclear Attack Submarines (SSN). SSNs are multi-mission platforms whose stealth enables clandestine intelligence collection; surveillance; anti-submarine warfare (ASW); anti-surface warfare (ASuW); special operations forces insertion and extraction; land attack strikes; and offensive mine warfare. The newest class of SSN, the Block V *Virginia* with the Virginia Payload Module (VPM) enhancement, is important to the Navy’s overall strike

U.S. vs. China and Russia Navies: Fleet Expansion Trends



NOTE: U.S. figures are actual through 2020. Figures for 2025 and 2030 are from the Navy’s December 2020 30-year shipbuilding plan. See U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities—OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF (accessed September 3, 2021).

SOURCES:

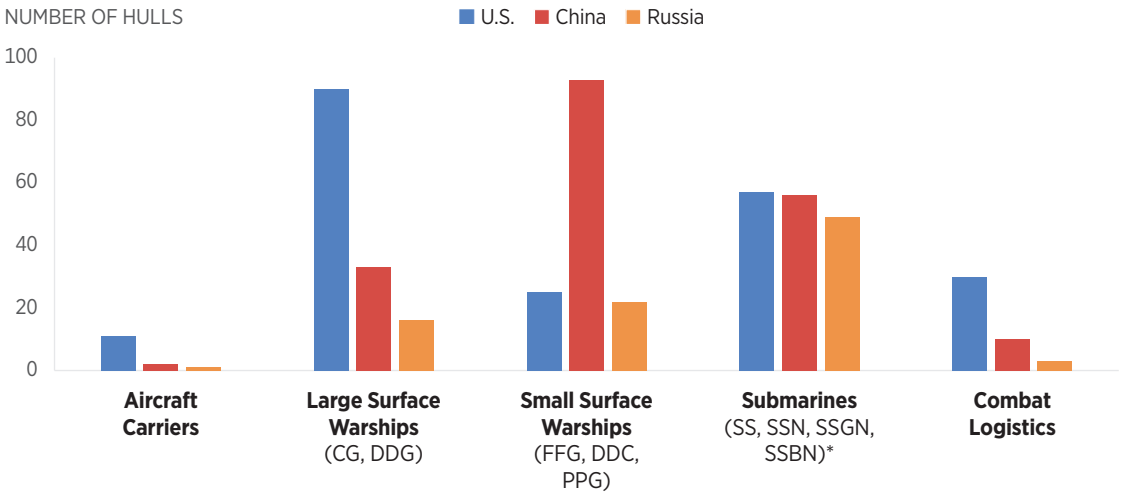
- Figure 1, “Growth of China’s Maritime Forces Since 2000,” in U.S. Department of the Navy, U.S. Marine Corps, and U.S. Coast Guard, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power*, December 2020, p. 4, <https://media.defense.gov/2020/Dec/16/2002553074/-1/-1/0/TRISERVICESTRATEGY.PDF> (accessed September 2, 2021).
- Table 2, “Numbers of Chinese and U.S. Navy Battle Force Ships, 2000–2030,” in Ronald O’Rourke, “China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress,” Congressional Research Service *Report for Members and Committees of Congress* No. RL33153, updated January 27, 2021, p. 32, <https://crsreports.congress.gov/product/pdf/RL/RL33153/248> (accessed September 2, 2021).
- U.S. Navy, Office of Naval Intelligence, *The Russian Navy: A Historic Transition*, December 2015, <https://nuke.fas.org/guide/russia/historic.pdf> (accessed September 2, 2021).
- Michael A. McDevitt, Rear Admiral, U.S. Navy (Ret.), prepared statement in hearing, *Department of Defense’s Role in Competing with China*, Committee of Armed Services, U.S. House of Representatives, 116th Cong. 2nd Sess., January 15, 2020, pp. 76–88, <https://www.govinfo.gov/content/pkg/CHRG-116hrg40508/pdf/CHRG-116hrg40508.pdf> (accessed September 2, 2021).

capacity, enabling the employment of an additional 28 Tomahawk cruise missiles over earlier SSN variants.⁴⁵

The FY 2021 National Defense Authorization Act included additional funds for advanced procurement that preserves a future

option to buy as many as 10 *Virginia*-class submarines through FY 2023. As indicated previously, increasing *Virginia*-class production has raised concerns regarding strain on the industrial base. Complicating matters is the recently revealed premature replacement

U.S. vs. China and Russia Navies: Hull Classes



* USN ballistic missile submarines are not included because their mission is strategic deterrence, which makes it unlikely that they will be employed in a combat zone.

SOURCES:

- Michael A. McDevitt, Rear Admiral, U.S. Navy (Ret.), prepared statement in hearing, *Department of Defense's Role in Competing with China*, Committee of Armed Services, U.S. House of Representatives, 116th Cong. 2nd Sess., January 15, 2020, pp. 76–88, <https://www.govinfo.gov/content/pkg/CHRG-116hhrg40508/pdf/CHRG-116hhrg40508.pdf> (accessed September 2, 2021).
- Graphic, “Major Naval Units,” in U.S. Department of Defense, Office of the Secretary of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2020*, p. 49, <https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF> (accessed September 3, 2021).
- International Institute for Strategic Studies, *The Military Balance 2021: The Annual Assessment of Global Military Capabilities and Defence Economics* (London: Routledge, 2021), pp. 196–199, 235–237, and 261–263, <https://www.iiss.org/publications/the-military-balance> (accessed September 3, 2021).

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of parts that were intended to last for the life of the boat. That such life-of-ship parts had to be replaced further taxes the ability of suppliers to meet the demand for new SSNs.⁴⁶

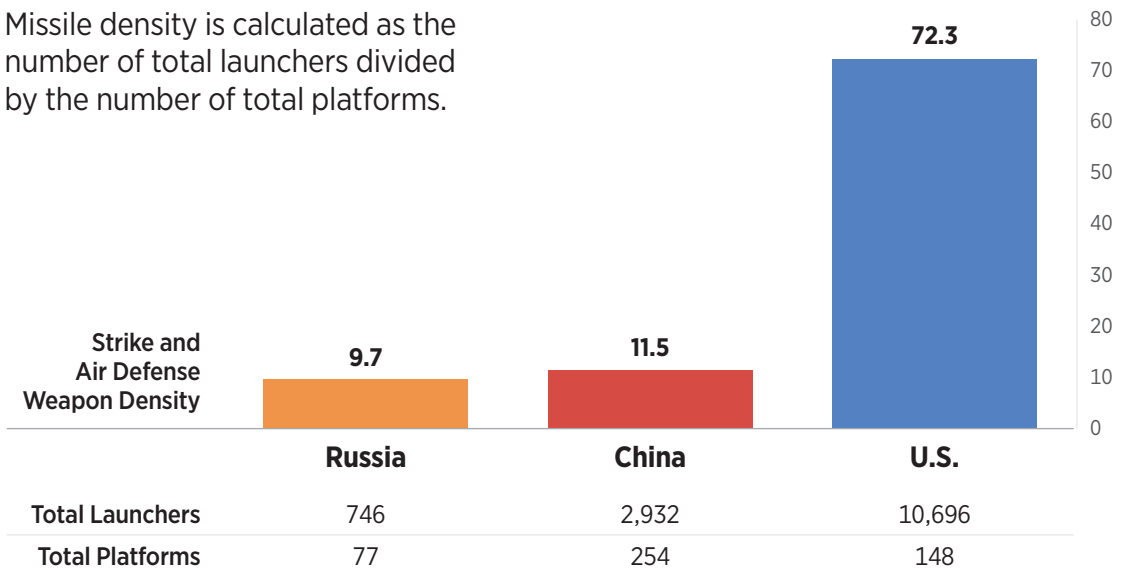
Aircraft Carriers (CVN). The Navy has 11 nuclear-powered aircraft carriers: 10 *Nimitz*-class and one *Ford*-class. The Navy has been making progress in overcoming nagging issues with several advanced systems, notably the advanced weapons elevators, but has not announced any delay in USS *Ford*'s first operational deployment in FY 2022.⁴⁷ The second ship in the class, USS *John F. Kennedy* (CVN

79), christened on December 7, 2019, is more than 76 percent complete. Given recent shifts in shipyard workloads due to later than anticipated *Kennedy* construction and planned *Nimitz* overhaul, the Navy recently renegotiated the *Kennedy* to single-phase contracting, which is intended to ensure that the ship is ready to support F-35C fighters before its anticipated delivery to the fleet on June 30, 2024.⁴⁸

Large Surface Combatants. The Navy's large surface combatants consist of the *Ticonderoga*-class cruiser, the *Zumwalt*-class destroyer, and the *Arleigh Burke*-class destroyer. If

U.S. vs. China and Russia Navies: Missile Density

Missile density is calculated as the number of total launchers divided by the number of total platforms.



NOTES: Numbers of launchers do not include reloads. Launchers include torpedo tubes, vertical launch tubes (submarine and surface ships), and mounted canister launchers.

SOURCES: U.S. Navy, Office of Information, “Fact Files,” <https://www.navy.mil/Resources/Fact-Files/> (accessed September 3, 2021), and Naval Sea Systems Command, Naval Vessel Register, “Ship Battle Forces,” <https://www.nvr.navy.mil/NVRSHIPS/SHIPBATTLEFORCE.HTML> (accessed September 3, 2021).

the Navy executes the President’s FY 2022 budget, it will decommission “15 Battle Force Ships” including seven cruisers.⁴⁹ The effect is a measurable reduction of the fleet’s aggregate firepower of 854 vertical launch tubes for launching strike and defensive weapons—a 9 percent reduction of overall surface fleet firepower. Attempts to extend the life of the aging *Ticonderoga*-class cruisers have yielded mixed results as deferred upgrades and past incomplete maintenance are now driving up operating costs.⁵⁰

In FY 2022, the Navy intends to procure one *Arleigh Burke*-class DDG 51 destroyer; there is no intention of resuming construction of *Zumwalt* destroyers beyond the three previously purchased and being built out. The first *Zumwalt* destroyer (DDG-1000) was delivered

on April 24, 2020; the second, USS *Michael Monsoor* (DDG-1001), was commissioned on January 26, 2019; and the third, USS *Lyndon B. Johnson* (DDG-1002), should complete construction in November 2021.⁵¹ The *Zumwalt* was to achieve initial operational capability (IOC) by September, but it is more likely that IOC will be achieved in December 2021.⁵²

To reach 355 ships by 2034, the Navy plans several class-wide service life extensions, notably the extension of DDG-51-class service life from 35 to 40 years and modernization of older hulls. The FY 2020 budget included \$4 billion for modernization of 19 destroyers from FY 2021 through FY 2024.⁵³ The previously noted decommissioning of seven cruisers in FY 2022 makes this more critical.

Small Surface Combatants. The Navy’s small surface combatants consist principally of the *Avenger*-class mine countermeasures (MCM) ship; the Littoral Combat Ship (LCS); and the *Constellation*-class frigate (FFG), which has just begun production in 2021. In January 2021, the Navy halted production of the mono-hull *Freedom*-variant of LCS until issues involving the design of its propulsion system are resolved. In the meantime, the top speed of affected ships (currently 40-plus knots) is reportedly limited to 34 knots.⁵⁴ Today’s fleet of 23 LCS (10 *Freedom*-variant and 13 *Independence*-variant) is expected to grow to 34 hulls, to be joined by 18 frigates by FY 2034.⁵⁵

On August 20, 2020, the Navy decommissioned three of its aging *Avenger*-class MCM ships, leaving eight in service overseas in Sasebo, Japan, and Manama, Bahrain. These represent the only dedicated ships countering the mine threat.⁵⁶ The FY 2020 budget accelerated retirement of all *Avenger*-class MCMs by FY 2023.⁵⁷ In what could be a reversal of that decision, the current long-range shipbuilding plan will retain the last four ships of the class in Sasebo, Japan, through 2024.⁵⁸

As these ships reach the end of their service life, the Navy is relying on the development of mine countermeasure mission packages (MPs) for the LCS to provide this capability, which will not reach IOC until FY 2022 at the earliest. In an unanticipated move, the Navy announced plans, supported in the FY 2022 budget, to begin arming LCS ships with the naval strike missile, giving these ships a long-range anti-ship capability that they had lacked despite notable operations by the class in the South China Sea.⁵⁹

Instead of requesting additional LCS, the Navy has focused on a new frigate. On April 30, 2020, the Navy awarded Fincantieri \$795 million to build the lead ship at its Marinette Marine shipyard in Wisconsin based on a proven design currently in service with the French and Italian navies.⁶⁰ The FY 2021 budget supported purchase of the second ship with annual procurement beginning in FY 2023.⁶¹ The Navy intends to expand production of these

frigates to four a year by FY 2025 with the addition of a second “follow yard” by FY 2023. Austal USA has broken new ground on a steel production facility in an effort to become this second yard.⁶²

Amphibious Ships. Commandant of the Marine Corps General David Berger issued the 38th Commandant’s Planning Guidance in July 2019 and Force Design 2030 in March 2020. Both documents signaled a break with past Marine Corps requests for amphibious lift, specifically moving away from the requirement for 38 amphibious ships to support an amphibious force of two Marine Expeditionary Brigades (MEB).⁶³ The Commandant envisions a larger yet affordable fleet of smaller, low-signature amphibious ships—the so-called Light Amphibious Warship (LAW)—that enable littoral maneuver and associated logistics support in a contested theater.⁶⁴ Today, the amphibious fleet remains centered on fewer large ships, but the Navy’s Future Naval Force Study (FNFS)⁶⁵ and December 2020 30-year shipbuilding plan acknowledged the growing importance of the LAW, which will have to be produced rapidly and in sufficient numbers in order to actualize the naval forces’ distributed concepts of operations (e.g., Marine Littoral Regiments and Maritime Distributed Operations).

As of July 14, 2021, the Navy had nine amphibious assault ships in the fleet (seven *Wasp*-class LHD and two *America*-class LHA); 11 amphibious transport docks (LPD); and 11 dock landing ships (LSD).⁶⁶ USS *Tripoli* (LHA-7) was delivered on February 28, 2020, and fabrication has begun on LHA-8, supporting delivery in FY 2024.⁶⁷

The FY 2021 budget included \$250 million in additional funds to accelerate construction of LHA-9.⁶⁸ The July 2020 catastrophic fire on *Bonhomme Richard* (LHD-6) makes it important that LHA-9 be delivered early so that the Navy can sustain its amphibious capacity. The decision to decommission the damaged ship further exposed limitations in shipyard capacity, as repairs would have had a negative effect on other planned shipbuilding and maintenance.⁶⁹

The Navy's 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. LPD-30 began construction in April 2020 and when delivered will be the first of 13 *San Antonio*-class Flight II ships to replace the legacy LSD ships. The 12th first flight *San Antonio*-class ship (LPD 28) will be delivered in September 2021,⁷⁰ and the FY 2021 budget included \$500 million "to maximize the benefit of the amphibious ship procurement authorities provided elsewhere in this Act through the procurement of long lead material for LPD-32 and LPD-33."⁷¹

Unmanned Systems. The Navy does not include unmanned ships in counting its battle force size, but the current long-range shipbuilding plan envisions purchasing 12 Large Unmanned Surface Vessels (LUSV); one Medium Unmanned Surface Vessel (MUSV); and eight Extra Large Undersea Unmanned Vessels (XLUUV) by FY 2026.⁷² This plan builds on the previous FY 2021–FY 2025 budget, which included \$12 billion for all naval unmanned air and sea platforms, an increase of 129 percent over FY 2020.⁷³ The June 2021 iteration of the Navy's long-range shipbuilding plan does not address the procurement of unmanned ships.⁷⁴

In April 2020, the Navy took delivery of its second MUSV *Sea Hunter* prototype. It will be joined in FY 2022 by two LUSV under Surface Development Squadron One (SURFDEVRON ONE), charged with developing associated operating requirements.⁷⁵ On May 18, 2021, one of these experimental LUSV vessels, the *Nomad*, was seen transiting the Panama Canal on its way to SURFDEVRON ONE.⁷⁶

In a show of concern about the maturity of technologies associated with unmanned systems, both the Senate and House Armed Services Committees stipulated in the FY 2021 NDAA that the Navy qualify the reliability of engines and power generators before procuring unmanned surface vessels.⁷⁷ Those concerns remain outstanding.

Until the March 2021 release of the Department of the Navy's Unmanned Campaign Framework, there had been no overarching

vision to guide the naval services' unmanned investments and operational strategies.⁷⁸ For example, in 2019, the Marine Corps' Long Range Unmanned Surface Vessel conducted autonomous navigation from Norfolk, Virginia, to Cherry Point, North Carolina. The Corps plans to procure three more of these long-range unmanned vessels for further testing.⁷⁹

As the Marine Corps' unmanned program has progressed, the Navy has also made independent progress, notably its April 2021 U.S. Pacific Fleet-led Unmanned Integrated Battle Problem 21 (IBP21) exercise. This fleet experiment brought together the Navy's *Zumwalt* destroyer and unmanned MUSVs with a range of sensitive air and undersea unmanned platforms to mature the technologies and techniques required for effective naval manned-unmanned operations.⁸⁰

Navy and Marine Corps unmanned programs also appear to be converging in the development of an expeditionary control station for the *Fire Scout* (MQ-8C) unmanned helicopter.⁸¹ If deployed, this control station would allow for flexible employment of the *Fire Scout* both from austere sites ashore and from a range of ships for anti-submarine as well as surface warfare missions. However, as the Navy and Marine Corps accelerate their investments in unmanned systems, future fleet experimentation will have to incorporate both services' platforms to ensure interoperability.

Logistics, Auxiliary, and Expeditionary Ships. Expeditionary support vessels are highly flexible platforms consisting of two types: Today there are two Expeditionary Transfer Dock (ESD) and three Expeditionary Sea Base (ESB) vessels, which are used for repositioning and sustaining forward operations, and 12 shallow-draft Expeditionary Fast Transport (EPF) vessels for high-speed lift in uncontested environments. Delivery of ESB 6 is planned for FY-2022, and delivery of ESB 7 is planned for FY 2023.⁸² *Newport* (EPF-12) was delivered to the Navy on September 2, 2021, and construction of *Apalachicola* (EPF-13) is progressing.⁸³ In March 2021, the Navy revised its contract with Austal USA for \$235 million to

modify EPF-14 and future EPF-15 to be high-speed hospital ships with the capability of embarking a V-22 tilt-rotor aircraft.⁸⁴

The Navy's Combat Logistics Force (CLF), consisting of dry-cargo and ammunition ships (T-AKE), fast combat support ships (T-AOE), and oilers (AO), provides critical support, to include at-sea replenishment, that enables the Navy to sustain the fleet at sea for prolonged periods. The Navy's future oiler *John Lewis* (T-AO 205) was launched on January 12, 2021, with delivery expected in June 2021 and an additional five to follow.⁸⁵ To sustain the fleet's number of oilers, the Navy will have to receive T-AO 205 and T-AO 206, both currently under construction, by FY 2023.⁸⁶

Strike Platforms and Key Munitions.

The FY 2021 and proposed FY 2022 budgets continued the Navy's focus on long-range, offensive strikes launched from ships, submarines, and aircraft. Notable investments include Conventional Prompt Strike (CPS); the Maritime Strike Tomahawk (MST); the Joint Standoff Weapon Extended Range (JSOW-ER); the Long-Range Anti-Ship Missile (LRASM); and the Standard Missile-6 (SM-6).

The FY 2021 budget sustained the rapid prototyping of upgraded SM-2 Block IIIC and SM-6 Block IB; procurement of Block V Tactical Tomahawk (TACTOM) cruise missiles and Navigation/Communication upgrade kits to improve performance in layered defense environments; and procurement of 48 LRASM.⁸⁷

To counter the threat posed by the Chinese PL-15 long-range air-to-air missile, which has an operational range of 186 miles, the Navy is working with the Air Force to develop the AIM-120 Advanced Medium-Range missile, the operational range of which has not been made public.⁸⁸ In March 2021, the Air Force reported a record long-range kill of a drone target by this developmental missile from one of its F-15C fighters.⁸⁹ If this report is accurate, it indicates that development is proceeding apace.

Shore-Based Anti-Ship Capabilities. Following the August 2019 U.S. withdrawal from the Intermediate-Range Nuclear Forces (INF) Treaty, new intermediate-range (500–1,000

miles) conventional ground-launched strike options became politically viable. This is especially important in Asia where such capable missiles deployed to the first island chain would have great relevance in any conflict with China.⁹⁰

The FY 2020 budget included \$76 million to develop ground-launched cruise missiles.⁹¹ The FY 2021 budget included \$59.6 million in additional funds to procure 36 ground-based anti-ship missiles.⁹² A photo of the launch of a U.S. Marine Corps truck-mounted naval strike missile—ostensibly, part of the Navy–Marine Expeditionary Ship Interdiction System (NMESIS)—was released in April 2021.⁹³

Electronic Warfare (EW). The purpose of electronic warfare is to control the electromagnetic spectrum (EMS) by exploiting, deceiving, or denying its use by an enemy while ensuring its use by friendly forces. It is therefore a critical element of successful modern warfare. The final dedicated EW aircraft, the EA-18G Growler, was delivered in July 2019, meeting the Navy's requirement to provide this capability to nine carrier air wings (CVW), five expeditionary squadrons, and one reserve squadron.⁹⁴ Anticipating the EA-18G's retirement in the 2030s, the Navy has been exploring follow-on manned and unmanned systems.

Air Early Warning. The E-2D forms the hub of the Naval Integrated Control-Counter Air system and provides critical Theater Air and Missile Defense capabilities. The Navy's FY 2021 budget supported the procurement of four aircraft with an additional 10 to be procured over the next two years.⁹⁵ The proposed FY 2022 budget conforms to this plan by including procurement of five new E-2D aircraft, thus sustaining effective air early warning and increasingly important air control of unmanned platforms.

High Energy Laser (HEL). HEL systems provide the potential to engage targets or shoot down missiles without being limited to how much ammunition can be carried onboard ship. A significant milestone was achieved when USS *Portland* (LPD-27) used its HEL Weapon System Demonstrator to shoot down

an unmanned aerial vehicle (UAV) over the Pacific on May 16, 2020.⁹⁶ This was followed by the Navy’s decision to begin installation of a HEL system—the HELIOS (60kw) laser—on destroyers in 2021 beginning with USS *Preble*.⁹⁷

HELIOS is a scalable laser system integrated into the ship’s weapons control and radar systems that can dazzle and confuse threats, disable small boats, or shoot down smaller air threats. However, until field testing against meaningful threat platforms is conducted across a range of weather conditions, the effectiveness of such systems remains unproven.

Command and Control. Networked communications are essential to successful military operations, and the information passed over these networks includes sensitive data from targeting to logistics. Cyber security, communications, and the information systems that generate and relay this information are therefore critical elements of the DOD information enterprise.

To enhance continuity, the Navy has consolidated information management in the Office of the Chief Information Officer (CIO). The Navy plans to spend \$4.17 billion from FY 2021–FY 2026 to bolster cyber defense and resiliency to attack.⁹⁸ On February 23, 2021, the Navy consolidated network and IT-related technical authorities in a newly formed office, Taskforce Overmatch.⁹⁹ At a May 10, 2021, event, the CNO described Taskforce Overmatch as a unified data construct at the operational and tactical level and part of the DOD Joint All Domain Command and Control architecture.¹⁰⁰ Such investments are meant to prevent competitors’ efforts to nullify the Navy’s technological advantage or interfere in its logistic infrastructure (much of it on unclassified networks).

Readiness

In the 1980s, the Navy had nearly 600 ships in the fleet and kept roughly 100 (17 percent) deployed at any one time. As of July 12, 2021, the fleet numbered 297 ships, of which 83 (28 percent) were at sea or deployed. With fewer ships carrying an unchanging operational

workload, training schedules become shorter while deployments become longer. The commanding officer’s discretionary time for training and crew familiarization is a precious commodity that is made ever scarcer by the increasing operational demands on fewer ships.

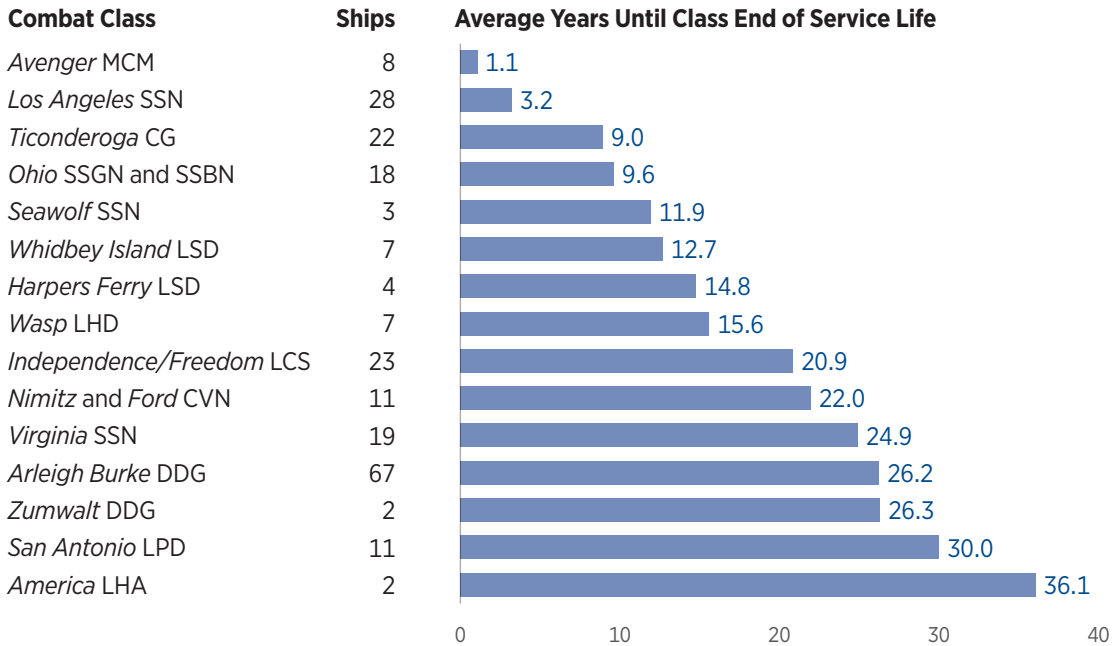
FY 2019 marked the first time in more than a decade that the DOD and the Navy did not have to operate under a continuing resolution for at least part of the fiscal year. Having a full fiscal year to plan and execute maintenance and operations helped the Navy to continue on its path to restoring fleet readiness. However, as CNO Admiral John Richardson explained to the Senate Armed Services Committee in April 2018, it will take until late 2021 or 2022 to restore fleet readiness to an “acceptable” level provided adequate funding is maintained, and without “stable and adequate funding,” it will take longer.¹⁰¹

Unfortunately, the Navy began FY 2020 under a continuing resolution that delayed planned maintenance for USS *Bainbridge* (DDG 96) and USS *Gonzalez* (DDG 66).¹⁰² This indicates that progress on fleet material readiness remains tenuous despite the fact that current and previous CNOs have made readiness their number one priority. Admiral Michael Gilday reiterated this most recently at a May 2021 Navy Memorial SITREP speaker event.¹⁰³

Impact of COVID-19. The eruption of the COVID-19 pandemic in 2020 caused many problems for the U.S. Navy. USS *Theodore Roosevelt* (CVN 71), for example, was forced to quarantine for 55 days in Guam; the major biannual international Rim of the Pacific Exercise (RIMPAC) was scaled down; 1,629 reservists were called to active duty to backfill high-risk shipyard workers conducting critical maintenance; and the Navy was restricted to using “safe haven” COVID-free ports, limiting where warships could call. In May 2021, the CNO assessed that the Navy managed the pandemic with minimal operational impact but with added time at sea and delays for family reunions pending quarantines.¹⁰⁴

In fact, the Navy’s response to the pandemic has been a success overall. As of June 2, 2021,

Navy Combat Ships Nearing End of Service Life



NOTE: Figures are based on calculations for August 2021.

SOURCE: Naval Sea Systems Command, Naval Vessel Register, "Fleet Size," <http://www.nvr.navy.mil/NVRSHIPS/FLEETSIZE.HTML> (accessed August 2, 2021).

 heritage.org

total cumulative COVID cases among the Navy's active-duty uniformed personnel numbered 38,849, with six deaths since February 2020.¹⁰⁵ Of the Navy's active-duty personnel on July 16, 2021, 78 percent were fully vaccinated, and 84.4 percent of sailors had received at least one shot, with both figures above the national average at the time.¹⁰⁶

Maintenance and Repairs. Naval Sea Systems Command completed its Shipyard Optimization and Recapitalization Plan in September 2018.¹⁰⁷ Three years later, the improvement of public shipyard capacities is just beginning. The initial step of building digital models to inform future upgrades to the Navy's four public shipyards is expected to be complete

by the end of 2021, but attempts by Congress to accelerate the breaking of new ground remain stalled.¹⁰⁸

At a May 10, 2021 event, the Chief of Naval Operations highlighted reducing the number of days of delayed maintenance at the four public yards by 80 percent and at private yards by 60 percent, improving maintenance planning at private shipyards, and giving yards more time to plan from contract approval to starting work as positive trends.¹⁰⁹ Nevertheless, the overall capacity for maintaining today's Navy, much less a fleet that is larger than 300 ships, remains inadequate.

Moreover, a recently declassified DOD Inspector General report that assessed readiness

issues with respect to the Navy's newest maritime patrol aircraft, the P-8A Poseidon, concluded that the platform's low capability rates were due to an inadequate sustainability strategy for the aircraft.¹¹⁰ A similar issue regarding spare parts for the *Virginia*-class nuclear submarine fleet came to light at a fall 2020 Navy League conference and in a subsequent Congressional Budget Office report.¹¹¹ Over a two-year period beginning in 2018, the cannibalization of otherwise life-of-ship parts had a marked early failure rate, reportedly because of galvanic corrosion, which occurs at the contact space of two dissimilar metals. This problem reflects either poor design decisions preceding construction of the submarine class or modification of materials used by suppliers without the Navy's knowledge. Either way, this material issue illustrates an ongoing need for better management of the transition from design to sustainment as well as better management of the Navy's supplier base.

Training, Ranges, and Live-Fire Exercises. Ship and aircraft operations and training are critical to fleet readiness. The Navy seeks to meet fleet readiness requirements by funding 58 underway days for each deployed warship and 24 underway days for each non-deployed warship per quarter. Less clear is how much of this time is spent on crew training and whether the Navy assesses this as effective in meeting needed operational proficiencies.

That said, to achieve desired days at sea, the Navy sought an increase of 6.4 percent in its FY 2022 operations budget,¹¹² slightly less than FY 2021's 6.5 percent increase to cover "ship operations funding."¹¹³ Importantly, the FY 2022 budget increases the Flying Hour program by 11.0 percent, continuing the previous year's 5.8 percent increase, to ensure that squadrons are combat-ready when deployed.¹¹⁴

To improve warfighting proficiency, the Navy is seeking to expand and update instrumentation of the training range at Naval Air Station Fallon, Nevada, to enable practice with the most advanced weapon systems.¹¹⁵

This training range fits into the larger five-year \$27.3 billion Pacific Deterrence Initiative (PDI), led by Indo Pacific Command, intended partly to transform the way the Navy trains for high-end conflict and improve training with U.S. allies in the Pacific.¹¹⁶ Of particular importance to the Navy are PDI investments to modernize the Pacific Missile Range Facility (PMRF); the Joint Pacific Alaska Range Complex (JPARC); and the Combined/Joint Military Training (CJMT) Commonwealth Northern Mariana Islands in order to improve training for operations across all domains: air, land, sea, space, and cyber.¹¹⁷

Not forgotten are the 2017 collisions of USS *John S. McCain* (DDG 56) and USS *Fitzgerald* (DDG 62) in which 17 sailors were lost. Findings of the subsequent investigations, which highlighted the importance of operational risk management and unit readiness, remain relevant.¹¹⁸ To ensure that these tragic events are not repeated, the following broad institutional recommendations in the Secretary of the Navy's *Strategic Readiness Review* should be implemented:

- "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."¹¹⁹

Scoring the U.S. Navy

Capacity Score: Weak

This *Index* assesses that a battle force consisting of 400 manned ships is required for the U.S. Navy to do what is expected of it today. The Navy’s current battle force fleet of 297 ships and intensified operational tempo combine to reveal a Navy that is much too small relative to its tasks. The result is a score of “weak,” which is unchanged from the *2021 Index*. Depending on the Navy’s ability to fund more aggressive growth options and service life extensions, its capacity score could be lower in the next edition of the *Index*.

Capability Score: Marginal Trending Toward Weak

The overall capability score for the Navy remains “marginal” with downward pressure as the Navy’s technological edge narrows against peer competitors China and Russia. The combination of a fleet that is aging faster than old ships are being replaced and the

rapid growth of competitor navies with modern technologies does not bode well for U.S. naval power.

Readiness Score: Marginal Trending Toward Weak

The Navy’s readiness is rated “marginal” trending toward “weak” as the Navy struggles to sustain overdue readiness corrective actions, complicated by an inadequate fleet size and overwhelmed maintenance infrastructure.

Overall U.S. Navy Score: Marginal Trending Toward Weak

The Navy’s overall score for the *2022 Index* is “marginal” trending toward “weak.” To correct this trend, the Navy will have to eliminate several readiness and capacity bottlenecks while seeing to it that America has an operational fleet with the numbers and capabilities postured to counter Russian and Chinese naval advances.

U.S. Military Power: Navy

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

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

Aircraft Carrier

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p><i>Nimitz-Class Aircraft Carrier (CVN-68)</i> Inventory: 10 Fleet age: 30.4 Date: 1975</p> <p>The <i>Nimitz</i>-class is a nuclear powered multipurpose carrier. The aircraft carrier and its embarked carrier air wing can perform a variety of missions including maritime security operations and power projection. Its planned service life is 50 years. The class will start retiring in the FY 2025 and will be replaced by the <i>Ford</i>-class carriers.</p>	3	3	<p><i>Ford-Class Aircraft Carrier (CVN-78)</i> Timeline: 2017-2032</p> <p>Currently in production, the <i>Ford</i>-class will replace the <i>Nimitz</i>-class aircraft carriers. The <i>Ford</i>-class design uses the basic <i>Nimitz</i>-class hull form but incorporates several improvements to achieve a 33 percent higher sortie rate, a smaller crew with approximately 600 fewer sailors, two and a half times greater electrical power, and more than \$4 billion in life-cycle cost savings over the <i>Nimitz</i>-class. The ship completed its first Full Ship Shock Trial (FSST) on June 18 and will complete the rest by the end of summer. Then it will enter a Planned Incremental Availability for six months before operational employment so that it can undergo modernization, maintenance, and repairs. The ship's intended life expectancy is 50 years.</p>	2	2
<p><i>Ford-Class Aircraft Carrier (CVN-78)</i> Inventory: 1 Fleet age: 4 Date: 2017</p> <p>The <i>Ford</i>-Class incorporates new technologies that will increase aircraft sortie rates, reduce manning, provide greater electrical power for future weapons systems, and decrease operating costs. Its planned service life is 50 years.</p>	5	4	<p>PROCUREMENT</p> <p>3</p> <p>SPENDING (\$ millions)</p> <p>\$37,803 \$15,558</p>		

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

Large Surface Combatant

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p><i>Ticonderoga</i>-Class Cruiser (CG-47)</p> <p>Inventory: 22 Fleet age: 31 Date: 1981</p> <p>The <i>Ticonderoga</i>-class is a multi-mission battle force ship equipped with the Aegis Weapons System. While it can perform strike, anti-surface warfare and anti-submarine warfare, its primary focus is air and missile defense. The ship has a life expectancy of 40 years, the Navy plans to retire eight of the 22 CGs between FY 2021 and FY 2024.</p>	2	3	<p><i>Zumwalt</i>-Class Destroyer (DDG-1000)</p> <p>Timeline: 2016–2022</p> <p>The DDG-1000 was designed to be a new-generation destroyer capable of handling more advanced weapon systems for long-range strike with a hull design capable of reducing aimed to reduce radar detectability for its original primary mission of naval surface fire support (NSFS). The DDG-1000 program was intended to produce a total of 32 ships, but this number has been reduced to three. The first DDG-1000 was commissioned in October 2016.</p>	1	1
<p><i>Zumwalt</i>-Class Destroyer (DDG-100)</p> <p>Inventory: 1 Fleet age: 3.6 Date: 2016</p> <p>The <i>Zumwalt</i>-Class is a multi-mission destroyer that incorporates several technological improvements, such as a stealthy hull design and integrated electric-drive propulsion system. Although it has passed sea trials, it continues to experience problems with its combat systems. The third and final <i>Zumwalt</i>-class ship was commissioned in FY 2020.</p>	5	2	<p>PROCUREMENT</p> <p>3</p> <p>SPENDING (\$ millions)</p> <p>\$23,427 \$753</p>		
<p><i>Arleigh Burke</i>-Class Destroyer (DDG-51)</p> <p>Inventory: 69 Fleet age: 18.7 Date: 1991</p> <p>The <i>Arleigh Burke</i>-class is a multi-mission guided missile destroyer featuring the Aegis Weapons System with a primary mission of air defense. The Navy was supposed to buy two in FY 2022, but President Biden's proposed budget would provide only one. This would break multiyear contracts and has received pushback from Congress, so the decision is still being debated. The Navy plans to extend the service life of the entire class to 45 years from its original life expectancy of 35–40 years.</p>	3	4	<p><i>Arleigh Burke</i>-Class Destroyer (DDG-51)</p> <p>Timeline: 1991–2029</p> <p>DDG-51 production was restarted in FY 2013 to make up for the reduction in DDG-1000 acquisitions. Beginning in FY 2017, all DDG-51s procured will be the Flight III design, which includes the more capable Advanced Missile Defense Radar (AMDR). The Navy was supposed to buy two in FY 2022, but President Biden's proposed budget would provide only one. This would break multiyear contracts and has received pushback from Congress, so the decision is still being debated. The destroyers are believed to have an extended life span of 45 years of operational service.</p>	3	4
			<p>PROCUREMENT</p> <p>87 1</p> <p>SPENDING (\$ millions)</p> <p>\$106,120 \$18,379</p>		

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

Small Surface Combatant

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p>Littoral Combat Ship (LCS) Inventory: 24 Fleet age: 4.1 Date: 2008</p> <p>The Littoral Combat Ship includes two classes: the <i>Independence</i>-class and the <i>Freedom</i>-class. The modular LCS design depends on mission packages (MPs) to provide warfighting capabilities in the SUW, ASW and MCM mission areas. The ship has an expected service life of 25 years.</p>	5		<p>Littoral Combat Ship (LCS) Timeline: 1991–2030</p> <p>The LCS is intended to fulfill the mine countermeasure, antisubmarine warfare, and surface warfare roles for the Navy. It is designed to operate in near-shore environments but is also capable of open-ocean operation. It works better with smaller ships than the DDG-51 does. It will be the only small surface combatant in the fleet once the Navy's MCM ships are retired and until the new FFG(X) enters service. The Navy will have six deployed by the end of the year.</p> <p>PROCUREMENT SPENDING (\$ millions)</p> <p>33 \$21,809 \$602</p>	2	2
<p>Avenger-Class Mine Counter Measure (MCM-1) Inventory: 8 Fleet age: 28.8 Date: 1983</p> <p>Avenger-class ships are designed as mine sweepers/hunter-killers capable of finding, classifying, and destroying moored and bottom mines. The class has an expected 30-year service life. The remaining MCMs are expected to be decommissioned throughout the 2020s. While there is no direct replacement single-mission MCM ship in production, the Navy plans to fill its mine countermeasure role with the LCS and its MCM MP.</p>			2		
			<p>FFG Frigate Timeline: 1991–2030</p> <p>A new program called the FFG(X) will augment the LCS program to fill out the remaining 20-ship small surface combatant requirement for a total of 52 Small Surface Combatants. The ships will be 496 feet with a top speed of 29 miles per hour and a range of 6,000 nautical miles. Its purpose is to escort carrier battle groups and high-value convoys. It will accommodate 32 VLS cells to handle high-powered missiles and machine guns. The first ship should be delivered by 2026 and be operational by 2030. The current contract would provide 10 hulls by 2035.</p> <p>PROCUREMENT SPENDING (\$ millions)</p> <p>2 1 \$2,334 \$1,088</p>		

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021
■ Pending

SSGN Cruise Missile Submarine

PLATFORM	Age Score	Capability Score	MODERNIZATION PROGRAM	Size Score	Health Score
<p>Ohio-Class (SSGN-726)</p> <p>Inventory: 4 Fleet age: 38.5 Date: 1981</p> <p>The SSGNs provide the Navy with a large stealthy strike and special operations mission capabilities. From 2002–2007, the four oldest <i>Ohio</i>-class ballistic missile submarines were converted to guided missile submarines. Each SSGN is capable of carrying up to 154 Tomahawk land-attack cruise missiles and up to 66 special operations forces for clandestine insertion and retrieval. All four SSGNs will be retired between FY 2026 and FY 2028. The Navy has tentative plans to replace the SSGNs with a new Large Payload Submarine beginning in FY 2036. The SSGN had a planned service life of 42 years, but this may be extended.</p>	1	4	None		

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

Attack Submarines

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p>Seawolf-Class (SSN-21) Inventory: 3 Fleet age: 21 Date: 1997</p> <p>The <i>Seawolf</i>-class is exceptionally quiet, fast, well-armed, and equipped with advanced sensors. Though lacking a vertical launch system, the <i>Seawolf</i>-class has eight torpedo tubes and can hold up to 50 weapons in its torpedo room. Although the Navy planned to build 29 submarines, the program was cut to three. The <i>Seawolf</i>-class has a 33-year expected service life. They have been succeeded by the <i>Virginia</i>-class attack submarine.</p>	3	4	<p>Virginia-Class (SSN-774) Timeline: 2004–2019</p> <p>The <i>Virginia</i>-class is in production and will replace the <i>Los Angeles</i>-class and <i>Seawolf</i>-class attack submarines as they are decommissioned. The Virginia Payload Module (VPM) will be incorporated into eight of the 11 planned Block V submarines beginning in FY 2019. VPM includes four large-diameter, vertical launch tubes that can carry up to 28 additional Tomahawk missiles or other payloads. The planned service life of the <i>Virginia</i>-class is 33 years. Thirty-four have been procured so far at a rate of two per year.</p>	2	3
<p>Los Angeles-Class (SSN-688) Inventory: 28 Fleet age: 30 Date: 1976</p> <p>The <i>Los Angeles</i>-class comprises the largest portion of the Navy's attack submarine fleet. They are multi-mission submarines that can perform covert intelligence collection, surveillance, ASW, ASuW, and land attack strike. The <i>Los Angeles</i>-class has a 33-year expected service life. The last <i>Los Angeles</i>-class submarine is expected to be retired in the late 2020s and is being replaced by the <i>Virginia</i>-class.</p>	1	3	<p>PROCUREMENT SPENDING (\$ millions)</p> <p>34 2 \$105,314 \$60,202</p>		
<p>Virginia-Class (SSN-774) Inventory: 19 Fleet age: 8 Date: 2004</p> <p>The <i>Virginia</i>-class is the U.S. Navy's next-generation attack submarine. It includes several improvements over previous attack submarine classes that provide increased acoustic stealth, improved SOF support, greater strike payload capacity and reduced operating costs. The planned service life of the <i>Virginia</i>-class is 33 years. The <i>Virginia</i>-class is in production and will replace the <i>Los Angeles</i>-class and <i>Seawolf</i>-class attack submarines as they are decommissioned. Thirty-four have been procured so far, at a rate of two per year.</p>	4	4			

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

SSBN Ballistic Missile Submarine

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p>Ohio-Class (SSBN)</p> <p>Inventory: 14 Fleet age: 31 Date: 1981</p> <p>The <i>Ohio</i>-class SSBN is the most survivable leg of the U.S. military's strategic nuclear triad. Its sole mission is strategic nuclear deterrence, for which it carries long-range submarine-launched ballistic missiles. The <i>Ohio</i>-class's expected service life is 42 years. Retirement of the class will begin in 2027 at an estimated rate of one submarine per year until 2039. The <i>Ohio</i>-class is being replaced by the <i>Columbia</i>-class SSBN.</p>	2	4	<p>Columbia-Class (SSBN-826)</p> <p>Timeline: TBD</p> <p>The 12-ship <i>Columbia</i>-class will replace the existing <i>Ohio</i>-class nuclear ballistic missile submarine force, which provides a credible and survivable sea-based strategic deterrent. The Navy's FY 2021 budget estimates that the total procurement cost for 12 ships will be \$109.8 billion. The first patrol of the lead ship, SSBN 826, is scheduled for FY 2031. However, the pandemic, technical challenges, and potential funding issues could cause the designing and building of the lead boat to be delayed. The <i>Columbia</i>-class ships will have a 42-year life expectancy.</p>		
			<p>PROCUREMENT</p> <p>1</p>	<p>SPENDING (\$ millions)</p> <p>\$21,428 \$106,176</p>	

Amphibious Warfare Ship

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p>Wasp-Class Amphibious Assault Ship (LHD-1)</p> <p>Inventory: 7 Fleet age: 24.3 Date: 1989</p> <p>The <i>Wasp</i>-class can support amphibious landing operations with Marine Corps landing craft through its well deck. It can also support Marine Air Combat Element operations with helicopters, tilt-rotor aircraft, and Vertical/Short Take-Off and Landing (V/STOL). This ship has a planned 40-year service life.</p>	2	3	<p>America-Class (LHA-6)</p> <p>Timeline: 2004-TBD</p> <p>LHA Flight 0 (LHA-6 and 7) were built without a well deck to provide more space for Marine Corps aviation maintenance and storage as well as increased JP-5 fuel capacity. LHA Flight 1 (LHA-8 and beyond) will reincorporate a well deck for increased mission flexibility. The <i>America</i>-class is in production with three LHA 6s already procured. Advance procurement for LHA 9 will begin in FY 2023.</p>	3	3
<p>America-Class Amphibious Assault Ship (LHA-6)</p> <p>Inventory: 2 Fleet age: 3.9 Date: 2014</p> <p>This new class of large-deck amphibious assault ships is meant to replace the retiring <i>Wasp</i>-class LHD. LHAs are the largest of all amphibious warfare ships and resemble small aircraft carriers. The <i>America</i>-class is designed to accommodate the Marine Corps' F-35Bs.</p>	5	4	<p>PROCUREMENT</p> <p>3</p>	<p>SPENDING (\$ millions)</p> <p>\$11,897 \$3,055</p>	

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

Amphibious Warfare Ship (Cont.)

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p>San Antonio-Class Amphibious Transport Dock (LPD-17)</p> <p>Inventory: 11 Fleet age: 9.9 Date: 2006</p> <p>The LPDs have well decks that allow the USMC to conduct amphibious operations with its landing craft. The LPD can also carry four CH-46s or two MV- 22s. Eleven of the planned 13 Flight I LPD- 17-class ships are operational, and the remaining two are under construction. The class has a 40-year planned service life.</p>	4		<p>San Antonio-Class Amphibious Transport Dock (LPD-17)</p> <p>Timeline: 2006-2017</p> <p>The 13 LPD-17s are replacements for the San Antonio-class LPDs. Both Flight I and Flight II LPDs are multi-mission ships designed to embark, transport, and land elements of a Marine landing force by helicopters, tilt rotor aircraft, landing craft, and amphibious vehicles.</p> <p>PROCUREMENT 13</p> <p>SPENDING (\$ millions) \$26,447 (Through FY 2021) / \$25,063 (Pending)</p>	5	4
<p>Whidbey Island-Class Dock Landing Ship (LSD-41)</p> <p>Inventory: 7 Fleet age: 32.2 Date: 1985</p> <p>LSD-41 Whidbey Island-class ships were designed specifically to transport and launch four Marine Corps Landing Craft Air Cushion vehicles. They have an expected service life of 40 years. All eight ships will be retired between FY 2026 and FY 2033. LSD-41-class ships will be replaced by the LPD-17 Flight II program, which began procurement in FY 2018.</p>	2	3	<p>LPD-17 Flight II</p> <p>Timeline: 2025-TBD</p> <p>Previously known as LX(R), the LPD-17 Flight II program will procure 13 ships to replace the Navy's LSD-type ships. The Navy originally planned to procure the first Flight II ship in FY 2020, but accelerated procurement funding enabled procurement of the first LPD-17 Flight II in FY 2018. The Navy delayed the second ship, planned for FY 2020, until FY 2021.</p> <p>PROCUREMENT 2</p> <p>SPENDING (\$ millions) \$2,926</p>	5	4
<p>Harpers Ferry-Class Dock Landing Ships (LSD-49)</p> <p>Inventory: 4 Fleet age: 25.1 Date: 1995</p> <p>The Harpers Ferry-class reduced LCAC capacity to two while increasing cargo capacity. They have an expected service life of 40 years, and all ships will be retired by FY 2038. The LSD-49 will be replaced by the LPD-17 Flight II, which began procurement in FY 2018.</p>		3			

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

Airborne Early Warning

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p>E-2C Hawkeye</p> <p>Inventory: 49 Fleet age: 38 Date: 1973</p> <p>The E-2C Hawkeye is a battle management and airborne early warning aircraft. The E-2C fleet received a series of upgrades to mechanical and computer systems around the year 2000. While still operational, the E-2C is nearing the end of its service life and is being replaced by the E-2D Advanced Hawkeye.</p>	1	3	<p>E-2D Advanced Hawkeye</p> <p>Timeline: 2014–2022</p> <p>The E-2D Advanced Hawkeye replaces the legacy E-2C and is in production. The Navy received approval for a five-year multi-year procurement plan beginning in FY 2019 for 24 aircraft to complete the program of record. The \$17.5 billion program has a goal to build 75 new aircraft.</p>	4	4
<p>E-2D Advanced Hawkeye</p> <p>Inventory: 45 Fleet age: 3.5 Date: 2014</p> <p>The E-2D program is the next-generation, carrier-based early warning, command, and control aircraft that provides improved battle space detection, supports theater air missile defense, and offers improved operational availability.</p>	5	4	<p>PROCUREMENT</p> <p>107 5</p> <p>SPENDING (\$ millions)</p> <p>\$19,160 \$6,001</p>		

Electronic Attack Aircraft

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
<p>EA-18G Growler</p> <p>Inventory: 158 Fleet age: 8 Date: 2009</p> <p>The EA-18G Growler is the U.S. Navy's electronic attack aircraft and provides tactical jamming and suppression of enemy air defenses. The final EA-18G aircraft was delivered in FY 2018, bringing the total to 160 aircraft and fulfilling the Navy's requirement. It replaced the legacy EA-6B Prowlers.</p>	5	4	None		

NOTE: See page 412 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES



Procurement and Spending ■ Through FY 2021 ■ Pending

Fighter/Attack Aircraft

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score						
<p>F/A-18E/F Super Hornet</p> <p>Inventory: 586 Fleet age: 17 Date: 2001</p> <p>The F/A-18 E/F Super Hornet has longer range, greater weapons payload, and increased survivability than the F/A-18A-D Legacy Hornet. The Navy plans to achieve a 50/50 mix of two F-35C squadrons and two F/A-18E/F Block III squadrons per carrier air wing by the mid-2030s. The ongoing service life extension program will extend the life of all Super Hornets to 9,000 flight hours.</p>	3	3	<p>F-35C Joint Strike Fighter</p> <p>Timeline: 2019-TBD</p> <p>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 Navy declared initial operational capability (IOC) of the F-35C in February 2019. The planned procurement of 273 F-35Cs will replace over 500 Super Hornets.</p> <p>PROCUREMENT SPENDING (\$ millions)</p> <table border="1"> <tr> <td>Procurement</td> <td>144</td> <td>20</td> </tr> <tr> <td>Spending (\$ millions)</td> <td>\$22,727</td> <td>\$2,109</td> </tr> </table>	Procurement	144	20	Spending (\$ millions)	\$22,727	\$2,109	2	3
Procurement	144	20									
Spending (\$ millions)	\$22,727	\$2,109									
<p>F-35C Joint Strike Fighter</p> <p>Inventory: 30 Fleet age: 1 Date: 2019</p> <p>The C-variant is the Navy's fifth-generation aircraft, bringing radar-evading technology to the carrier deck for the first time. The F-35C performs a variety of missions to include air-to-air combat, air-to-ground strikes, and ISR missions.</p>	5	4	<p>F/A-18 Super Hornet</p> <p>The Navy plans to buy 108 Block III Super Hornets by 2024 and modernize most of its existing Super Hornets to Block II standards. All of the Block III Super Hornets will have a life span of 10,000 flight hours, which is 50 percent greater than that of earlier F/A-18E/F aircraft. The Biden Administration's proposed budget would decrease the Navy's aviation budget, which would eliminate the planned purchase of Super Hornets.</p>								

NOTES: See Methodology for descriptions of scores. Fleet age is the average of platform since commissioning. The date for ships is the year of commissioning. Inventory for aircraft is estimated based on the number of squadrons. The date for aircraft is the year of initial operational capability. The timeline for ships is from the year of first commissioning to the year of last delivery. The timeline for aircraft is from the year of first year of delivery to the last year of delivery. Spending does not include advanced procurement or research, development, test, and evaluation (RDT&E). 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.

U.S. Navy Modernization Table Citations

GENERAL SOURCES

- U.S. Navy, Naval Sea Systems Command, "Naval Vessel Register," <https://www.nvr.navy.mil/> (accessed August 20, 2021).
- "North America," in International Institute for Strategic Studies, *The Military Balance 2021: The Annual Assessment of Global Military Capabilities and Defence Economics* (London: Routledge, 2021).
- U.S. Department of Defense, "Department of Defense Comprehensive Selected Acquisition Reports for the Annual 2019 Reporting Requirement as Updated by the President's Fiscal Year 2021 Budget," <https://media.defense.gov/2020/Nov/19/2002538295/-1/-1/0/SAR-SUMMARY-TABLES-DEC-2019-UPDATED.PDF> (accessed August 20, 2021).
- U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Navy, Justification Book Volume 1 of 3: Aircraft Procurement, Navy, Budget Activities 01-04*, May 2021, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/APN_BA1-4_Book.pdf (accessed August 20, 2021).
- U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Navy, Justification Book Volume 1 of 1: Shipbuilding and Conversion, Navy*, May 2021, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/SCN_Book.pdf (accessed August 20, 2021).

PROGRAM SOURCES

Ford-Class Aircraft Carrier

- Press release, "USS Gerald R. Ford (CVN 78) Completes First Full Ship Shock Trial Event," U.S. Navy, June 18, 2021, <https://www.navy.mil/Press-Office/Press-Releases/display-pressreleases/Article/2663444/uss-gerald-r-ford-cvn-78-completes-first-full-ship-shock-trial-event/> (accessed August 20, 2021).
- Newport News Shipbuilding, "Ford Class Aircraft Carriers: CVN 78," <https://www.thefordclass.com/cvn-78/> (accessed August 20, 2021).

Columbia-Class Ballistic Missile Submarine

- Ronald O'Rourke, "Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. R41129, updated June 24, 2021, <https://crsreports.congress.gov/product/pdf/R/R41129/206> (accessed August 20, 2021).
- Franz-Stefan Gady, "US Navy's Deadly New Nuclear Sub Finally Has a Name," *The Diplomat*, December 16, 2016, <https://thediplomat.com/2016/12/us-navys-deadly-new-nuclear-sub-finally-has-a-name/> (accessed August 20, 2021).

Arleigh Burke-Class Destroyer

- Joe Gould, "Democratic Appropriators Want to Spend More on Weapons Procurement than Biden," *Defense News*, June 29, 2021, <https://www.defensenews.com/congress/2021/06/29/house-pentagon-spending-bill-bumps-up-weapons-procurement/> (accessed August 20, 2021).
- Richard Abott, "Navy Says It Will Extend Life of All DDG-51s, Reaching 355 Ships in 2030s," *Defense Daily*, April 13, 2018, <https://www.defensedaily.com/navy-says-will-extend-life-ddg-51s-reaching-355-ships-2030s/navy-usmc/> (accessed August 20, 2021).

Littoral Combat Ship

- Sam LaGrone, "Six Littoral Combat Ships to Deploy by Year's End as Navy Continues to Refine Operations," U.S. Naval Institute News, June 28, 2021, <https://news.usni.org/2021/06/28/six-littoral-combat-ships-to-deploy-by-years-end-as-navy-continues-to-refine-operations> (accessed August 20, 2021).
- Andrew Dyer, "After 15 Years, the Navy's Littoral Combat Ships Are Still in Search of a Mission," *The San Diego Union-Tribune*, May 15, 2021, <https://www.sandiegouniontribune.com/news/military/story/2021-05-15/littoral-combat-ship-mission> (accessed August 20, 2021).

FFG(X)

- John Keller, "The Navy's New FFG(X) Frigate Warship Will Be Right-Sized and -Armed for the Crucial Open-Ocean Escort Role," *Military & Aerospace Electronics*, June 2, 2020, <https://www.militaryaerospace.com/blogs/article/14176965/frigate-armament-electronics> (accessed August 20, 2021).
- Joe Saballa, "Lockheed Martin Designing Combat System for New US Navy Frigates," *The Defense Post*, July 1, 2021, <https://www.thedefensepost.com/2021/07/01/lockheed-designing-combat-system-frigates/> (accessed August 20, 2021).
- Megan Eckstein, "Fincantieri Wins \$795M Contract for Navy Frigate Program," U.S. Naval Institute News, April 30, 2020, <https://news.usni.org/2020/04/30/fincantieri-wins-795m-contract-for-navy-frigate-program> (accessed August 20, 2021).

Virginia-Class

- Ronald O'Rourke, "Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. RL32418, July 29, 2021, <https://fas.org/sgp/crs/weapons/RL32418.pdf> (accessed August 20, 2021).

E-2D Advanced Hawkeye

- "E-2D Hawkeye: The Navy's New AWACS," *Defense Industry Daily*, August 16, 2021, <https://www.defenseindustrydaily.com/e-2d-hawkeye-the-navys-new-awacs-03443/> (accessed August 20, 2021).

F/A-18 Super Hornet

- Vicky Hartzler, "Hartzler: President Biden's Budget Fails St. Louis and Our F-18 Fleet. Here's How," *St. Louis Post-Dispatch*, June 29, 2021, https://www.stltoday.com/opinion/columnists/hartzler-president-biden-s-budget-fails-st-louis-and-our-f-18-fleet-here-s/article_d93a2acf-912f-59d9-bc3c-b473d887b885.html (accessed August 20, 2021).

F-35C Joint Strike Fighter

- Mark Episkopos, "This F-35C Stealth Fighter Will Be the Star of the Navy's Sea Strategy," *The National Interest*, The Buzz Blog, June 29, 2021, <https://nationalinterest.org/blog/buzz/f-35c-stealth-fighter-will-be-star-navy%E2%80%99s-sea-strategy-188828> (accessed August 20, 2021).

Ohio-Class

- Megan Eckstein, "Navy May Extend Life of Ohio SSBNs to Provide Cushion for Introduction of Columbia-Class," U.S. Naval Institute News, updated December 24, 2020, <https://news.usni.org/2020/11/16/navy-may-extend-life-of-ohio-ssbns-to-provide-cushion-for-introduction-of-columbia-class> (accessed August 20, 2021).

Endnotes

1. The Honorable Thomas B. Modly, Acting Secretary of the Navy; Admiral Michael M. Gilday, Chief of Naval Operations; and General David H. Berger, Commandant of the U.S. Marine Corps, statement “On Fiscal Year 2021 Department of the Navy Budget” before the Committee on Armed Services, U.S. Senate, March 5, 2020, p. 21, https://www.armed-services.senate.gov/imo/media/doc/Modly--Gilday--Berger_03-05-20.pdf (accessed July 12, 2021). Emphasis in original. See also stenographic transcript, *Hearing to Receive Testimony on Posture of the Navy in Review of the Defense Authorization Request for Fiscal Year 2021 and the Future Years Defense Program*, Committee on Armed Services, U.S. Senate, March 4, 2020, p. 9, https://www.armed-services.senate.gov/imo/media/doc/20-14_03-05-2020.pdf (accessed July 12, 2021).
2. Figure 1-7, “FY 2022 DON Total Budget Request by Appropriation \$211.7B,” in U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, 2021, p. 1-23, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf (accessed July 12, 2021). Total cited in title of table includes \$47.9 billion for the U.S. Marine Corps.
3. *Ibid.*, pp. 1-3 and 1-4.
4. Emily Jacobs, “Pentagon Says Suez Canal Traffic Impacted US Military Vessel Movement,” *New York Post*, March 29, 2021, <https://nypost.com/2021/03/29/pentagon-says-suez-canal-traffic-will-impact-us-military/> (accessed July 12, 2021).
5. See The Heritage Foundation, “The New 2020 Tri-Service Maritime Strategy—‘Advantage at Sea,’” *Factsheet* No. 195, January 19, 2021, https://www.heritage.org/sites/default/files/2021-01/FS_195_0.pdf.
6. President Joseph R. Biden, Jr., *Interim National Security Strategic Guidance*, The White House, March 2021, <https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf> (accessed July 11, 2021).
7. U.S. Department of the Navy, U.S. Marine Corps, and U.S. Coast Guard, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power*, December 2020, <https://media.defense.gov/2020/Dec/16/2002553074/-1/-1/0/TRISERVICESTRATEGY.PDF> (accessed July 11, 2021).
8. James Mattis, Secretary of Defense, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military’s Competitive Edge*, U.S. Department of Defense, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf> (accessed July 11, 2021).
9. The Global Force Management Allocation Plan (GFMAP) is a classified document that specifies forces to be provided by the services for use by operational commanders. It is an extension of a reference manual maintained by the Joint Staff, *Global Force Management Allocation Policies and Procedures* (CJCSM 3130.06B), which is also a classified publication. See U.S. Department of Defense, Joint Chiefs of Staff, “Adaptive Planning and Execution Overview and Policy Framework,” unclassified Chairman of the Joint Chiefs of Staff Guide 3130, March 5, 2019, p. B-2, <https://www.jcs.mil/Portals/36/Documents/Library/Handbooks/CJCS%20GUIDE%203130.pdf?ver=2019-03-18-122038-003> (accessed July 11, 2021).
10. U.S. Department of Defense, Department of the Navy, Office of the Secretary, “General Guidance for the Classification of Naval Vessels and Battle Force Ship Counting Procedures,” SECNAV Instruction 5030.8C, June 14, 2016, pp. 1–2, <http://www.nvr.navy.mil/5030.8C.pdf> (accessed July 12, 2021).
11. Thomas Callender, “The Nation Needs a 400-Ship Navy,” Heritage Foundation *Special Report* No. 205, October 26, 2018, <https://www.heritage.org/defense/report/the-nation-needs-400-ship-navy>. For an analysis regarding future force design out to 2035, see Brent D. Sadler, “Rebuilding America’s Military: The United States Navy,” Heritage Foundation *Special Report* No. 242, February 18, 2021, pp. 3–5, 7, 71, 75, and 83, <https://www.heritage.org/defense/report/rebuilding-americas-military-the-united-states-navy>.
12. 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.
13. U.S. Navy, “Executive Summary: 2016 Navy Force Structure Assessment (FSA),” December 15, 2016, p. 2, <http://static.politico.com/b9/99/0ad9f79847bf8e8f6549c445f980/2016-navy-force-structure-assessment-fsa-executive-summary.pdf> (accessed July 12, 2021). The full FSA was not released to the public. Importantly, in July 2019, the Marine Corps cancelled the requirement for 38 amphibious ships as a formal force-sizing demand for the Navy. General David H. Berger, Commandant of the Marine Corps, stated his belief that future naval warfare and the Marine Corps’ role in it against a peer competitor will require new types of smaller vessels that will be harder for an enemy to find and target, as well as able to support an evolving concept of distributed naval warfare more effectively, and that can be purchased in greater quantity at a lower price per vessel. Nevertheless, the long-standing 38-ship requirement has informed Navy shipbuilding plans and remains a central factor in current ship acquisition contracts. See General David H. Berger, “Commandant’s Planning Guidance, 38th Commandant of the Marine Corps,” U.S. Department of the Navy, U.S. Marine Corps, p. 4, https://www.hqmc.marines.mil/Portals/142/Docs/%2038th%20Commandant%27s%20Planning%20Guidance_2019.pdf?ver=2019-07-16-200152-700 (accessed July 12, 2021).

14. Bryan Clark and Jesse Sloman, "Deploying Beyond Their Means: America's Navy and Marine Corps at a Tipping Point," Center for Strategic and Budgetary Assessments, November 18, 2015, pp. 5–8, [https://csbaonline.org/uploads/documents/CSBA6174_\(Deploying_Beyond_Their_Means\)Final2-web.pdf](https://csbaonline.org/uploads/documents/CSBA6174_(Deploying_Beyond_Their_Means)Final2-web.pdf) (accessed July 12, 2021).
15. Daniel Whiteneck, Michael Price, Neil Jenkins, and Peter Swartz, "The Navy at a Tipping Point: Maritime Dominance at Stake?" Center for Naval Analyses, March 2010, p. 7, https://www.cna.org/CNA_files/PDF/D0022262.A3.pdf (accessed July 12, 2021).
16. Megan Eckstein, "No Margin Left: Overworked Carrier Force Struggles to Maintain Deployments After Decades of Overuse," U.S. Naval Institute News, November 12, 2020, <https://news.usni.org/2020/11/12/no-margin-left-overworked-carrier-force-struggles-to-maintain-deployments-after-decades-of-overuse> (accessed July 12, 2021).
17. U.S. Navy, Office of Information, "Status of Ships Underway July 12, 2021," <https://www.navy.mil/About/Mission/> (accessed July 12, 2021).
18. U.S. Navy, U.S. Marine Corps, and U.S. Coast Guard, *Naval Operations Concept 2010: Implementing the Maritime Strategy*, p. 26, <https://fas.org/irp/doddir/navy/noc2010.pdf> (accessed July 12, 2021).
19. On average, rotational deployments require four ships for one ship to be forward deployed. This is necessary because one ship is sailing out to a designated location, one is at location, one is sailing back to the CONUS, and one is in the CONUS for maintenance.
20. Figure 4, "Comparison of Forward-Presence Rates Provided on an Annual Basis for Ships Homeported in the United States and Overseas," in U.S. Government Accountability Office, *Navy Force Structure: Sustainable Plan and Comprehensive Assessment Needed to Mitigate Long-Term Risks to Ships Assigned to Overseas Homeports*, GAO-15-329, May 2015, p. 13, <https://www.gao.gov/assets/680/670534.pdf> (accessed July 12, 2021).
21. See Section 1025, "Policy of the United States on Minimum Number of Battle Force Ships," in H.R. 2810, National Defense Authorization Act for Fiscal Year 2018, Public Law 115-91, 115th Cong., December 12, 2017, <https://www.congress.gov/115/plaws/publ91/PLAW-115publ91.pdf> (accessed July 12, 2021).
22. The Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition (RD&A); Vice Admiral William R. Merz, Deputy Chief of Naval Operations for Warfare Systems (OPNAV N9); and Lieutenant General David H. Berger, Deputy Commandant, Combat Development and Integration, and Commanding General, Marine Corps Combat Development Command, statement on "The Department of the Navy Fiscal Year 2020 Budget Request for Seapower and Projection Forces" before the Subcommittee on Seapower and Projection Forces, Committee on Armed Services, U.S. House of Representatives, March 26, 2019, p. 3, https://armedservices.house.gov/_cache/files/9/1/919f5faa-95da-41d8-88b9-395b063c36ee/C72CB2C30F9989D64E8C8BF8F1A18801.hhrg-116-as28-wstate-geurtsj-20190326.pdf (accessed July 12, 2021).
23. Figure 2.2, "Shipbuilding Procurement Quantities and Total Funding," in U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, p. 2-3.
24. Section 123, "Sense of Congress on Accelerated Production of Aircraft Carriers," in H.R. 5515, John S. McCain National Defense Authorization Act for Fiscal Year 2019, Public Law 115-232, 115th Cong., August 13, 2018, <https://www.congress.gov/115/plaws/publ232/PLAW-115publ232.pdf> (accessed July 12, 2021).
25. Paul McLeary, "Navy Scraps Big Carrier Study, Clears Desk for OSD Effort," *Breaking Defense*, May 12, 2020, <https://breakingdefense.com/2020/05/navy-scraps-big-carrier-study-clears-deck-for-osd-effort/> (accessed July 12, 2021).
26. Table 1, "Numbers of Certain Types of Chinese and U.S. Ships Since 2005," in Ronald O'Rourke, "China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. RL33153, updated March 9, 2021, pp. 30–31, <https://assets.documentcloud.org/documents/20509332/china-naval-modernization-implications-for-us-navy-capabilities-background-and-issues-for-congress-march-9-2021.pdf> (accessed July 12, 2021).
27. U.S. Department of Labor, Bureau of Labor Statistics, "Occupational Employment and Wage Statistics: May 2020 National Industry-Specific Occupational Employment and Wage Estimates, NAICS 336600—Ship and Boat Building," occupation code 51-4121, last modified March 31, 2021, https://www.bls.gov/oes/current/naics4_336600.htm (accessed August 16, 2021), and U.S. Department of Labor, Bureau of Labor Statistics, "Occupational Employment and Wage Statistics: May 2017 National Industry-Specific Occupational Employment and Wage Estimates, NAICS 336600—Ship and Boat Building," occupation code 51-4121, last modified March 30, 2018, https://www.bls.gov/oes/2017/may/naics4_336600.htm (accessed August 16, 2021).
28. The Navy's FY 2020 30-year shipbuilding plan identified opportunities to build three additional *Virginia*-class submarines over the next six years and an additional nine next-generation SSNs between FY 2037 and FY 2049. The Navy's FY 2020 budget requested three *Virginia*-class SSNs. This is the first time in over 20 years that the Navy has procured three SSNs in one fiscal year. Since the advance procurement for the third *Virginia* SSN was not included in the Navy's FY 2019 budget, construction of this third submarine most likely will not commence until FY 2023. Critical parts and equipment for this additional submarine above the planned 10-submarine block buy have not been purchased yet, and the shipyards (Electric Boat and Huntington Ingalls Industries Newport News Shipbuilding) have not planned for this submarine as part of their *Virginia*-class construction.

29. Ronald O'Rourke, "Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. RL32418, June 24, 2021, pp. 12–13, <https://fas.org/sgp/crs/weapons/RL32418.pdf> (accessed July 13, 2021).
30. Modly, Gilday, and Berger, statement "On Fiscal Year 2021 Department of the Navy Budget," pp. 23–24.
31. Testimony of Admiral Mike Gilday, Chief of Naval Operations, in transcript of "Hearing on Fiscal 2022 Budget Request for the Navy and Marine Corps," Subcommittee on Defense, Committee on Appropriations, U.S. House of Representatives, April 29, 2021, in U.S. Navy, Office of Information, "CNO Gilday at HAC-D Navy Posture Hearing," <https://www.navy.mil/Press-Office/Testimony/display-testimony/Article/2590426/cno-gilday-at-hac-d-navy-posture-hearing/> (accessed July 14, 2021).
32. Vice Admiral Robert P. Burke, U.S. Navy, Chief of Naval Personnel and Deputy Chief of Naval Operations (Manpower, Personnel, Training & Education), statement on "Personnel Posture of the Armed Services" before the Subcommittee on Personnel, Committee on Armed Services, U.S. Senate, February 14, 2018, p. 11, https://www.armed-services.senate.gov/imo/media/doc/Burke_02-14-18.pdf (accessed August 16, 2021).
33. U.S. Navy, Naval History and Heritage Command, "U.S. Ship Force Levels 1886–Present," <https://www.history.navy.mil/research/histories/ship-histories/us-ship-force-levels.html> (accessed August 17, 2021), and U.S. Navy, Naval History and Heritage Command, "U.S. Navy Personnel Strength, 1775 to Present," published July 27, 2020, <https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/u/usn-personnel-strength.html> (accessed August 17, 2021).
34. U.S. Navy, Office of Information, "Our People Updated on June 10, 2021," <https://www.navy.mil/About/Mission/> (accessed July 14, 2021).
35. U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2020 Budget*, 2019, p. 2-2, <https://www.secnav.navy.mil/fmc/fmb/Documents/20pres/Budget%20Highlights%20Book.pdf> (accessed July 14, 2021).
36. Modly, Gilday, and Berger, statement "On Fiscal Year 2021 Department of the Navy Budget," p. 25.
37. U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, Department of the Navy Budget Card, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/DON_Budget_Card.pdf (accessed July 14, 2021).
38. U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, pp. 9-1 and 9-2.
39. U.S. Government Accountability Office, *Navy Readiness: Additional Efforts Are Needed to Manage Fatigue, Reduce Crewing Shortfalls, and Implement Training*," GAO-21-366, May 27, 2021, pp. 3–5, 10–12, and 17–19, <https://assets.documentcloud.org/documents/20792544/navy-readiness-additional-efforts-are-needed-to-manage-fatigue-reduce-crewing-shortfalls-and-implement-training-may-27-2021.pdf> (accessed July 14, 2021).
40. News release, "The Department of Defense Releases the President's Fiscal Year 2022 Defense Budget," U.S. Department of Defense, May 28, 2021, <https://www.defense.gov/Newsroom/Releases/Release/Article/2638711/the-department-of-defense-releases-the-presidents-fiscal-year-2022-defense-budg/> (accessed July 14, 2021), and Economic News Release, "Consumer Price Index Summary," U.S. Department of Labor, Bureau of Labor Statistics, August 11, 2021, <https://www.bls.gov/news.release/cpi.nr0.htm> (accessed August 16, 2021).
41. U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, pp. 1-12, 1-22, and 1-23.
42. Table, "Research & Development," in U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, Department of the Navy Budget Card.
43. Modly, Gilday, and Berger, statement "On Fiscal Year 2021 Department of the Navy Budget," p. 10.
44. David B. Larter, "US Navy Inks \$9.4B Contract for Two Columbia-Class Nuclear Missile Submarines," *Defense News*, November 5, 2020, <https://www.defensenews.com/naval/2020/11/05/navy-inks-contract-for-two-columbia-class-nuclear-missile-submarines/> (accessed July 13, 2021).
45. David B. Larter, "The US Navy, Seeking Savings, Shakes up Its Plans for More Lethal Attack Submarines," *Defense News*, April 3, 2019, <https://www.defensenews.com/naval/2019/04/04/the-us-navy-seeking-savings-shakes-up-its-plans-for-more-lethal-attack-submarines/> (accessed July 13, 2021).
46. Megan Eckstein, "Submarine Industrial Base Under Strain as Virginia-Class Parts Wearing out Early; Implications for Columbia-Class," U.S. Naval Institute News, April 20, 2021, <https://news.usni.org/2021/04/20/submarine-industrial-base-under-strain-as-virginia-class-parts-wearing-out-early-implications-for-columbia-class> (accessed July 13, 2021).
47. Megan Eckstein, "As USS Gerald R. Ford Nears Shock Trials, Carrier Remains Busy with Testing, Fleet Support," U.S. Naval Institute News, March 12, 2021, <https://news.usni.org/2021/03/12/as-uss-gerald-ford-nears-shock-trials-carrier-remains-busy-with-testing-fleet-support> (accessed July 13, 2021).
48. Megan Eckstein, "Navy Shifts Future Carrier JFK to Single-Phase Delivery with F-35C Modifications Included," U.S. Naval Institute News, November 2, 2020, <https://news.usni.org/2020/11/02/navy-shifts-future-carrier-jfk-to-single-phase-delivery-with-f-35c-modifications-included> (accessed July 13, 2021).

49. Exhibit OP-5, 2B2G, "Department of the Navy, FY 2022 President's Budget Submission, Operation and Maintenance, Navy Budget Activity: Mobilization, Activity Group: Activations/Inactivations, Detail by Subactivity Group: Activations/Inactivations, Planned FY 2022 Decommissions (15 Battle Force Groups)," in U.S. Department of the Navy, *Department of the Navy Fiscal Year (FY) 2022 Budget Estimates, Justification of Estimates, Operation and Maintenance, Navy*, May 2021, p. 4 of 16, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/OMN_Book.pdf (accessed July 14, 2021).
50. Megan Eckstein, "Navy 'Struggling' to Modernize Aging Cruiser Fleet as Tight Budgets Push Pentagon to Shed Legacy Platforms," U.S. Naval Institute News, April 5, 2021, <https://news.usni.org/2021/04/05/navy-struggling-to-modernize-aging-cruiser-fleet-as-tight-budgets-push-pentagon-to-shed-legacy-platforms> (accessed July 13, 2021).
51. Naval Sea Systems Command Public Affairs, "Navy Accepts Delivery of Destroyer USS Zumwalt," Commander, U.S. Pacific Fleet, April 24, 2020, <https://www.cpf.navy.mil/news.aspx/130601> (accessed July 14, 2021).
52. U.S. Navy, Naval Sea Systems Command, "Destroyers (DDG 1000)," *Fact File*, last updated April 27, 2021, <https://www.navy.mil/Resources/Fact-Files/Display-FactFiles/Article/2391800/destroyers-ddg-1000/> (accessed July 14, 2021), and The Honorable James F. Geurts, Assistant Secretary of the Navy, Research, Development & Acquisition ASN(RD&A); Vice Admiral James W. Kilby, Deputy Chief of Naval Operations, Warfighting Requirements and Capabilities (OPNAV N9); and Lieutenant General Eric Smith, Deputy Commandant, Combat Development and Integration, Commanding General, Marine Corps Combat Development Command, statement on "The Department of the Navy Fiscal Year 2021 Budget Request for Seapower and Projection Forces" before the Subcommittee on Seapower and Projection Forces, Committee on Armed Services, U.S. House of Representatives, March 4, 2020, p. 11, <https://www.congress.gov/116/meeting/house/110637/witnesses/HHRG-116-AS28-Wstate-GeurtsJ-20200304.pdf> (accessed July 14, 2021).
53. Admiral John M. Richardson, Chief of Naval Operations, statement on "Fiscal Year 2020 Navy Budget" before the Subcommittee on Defense, Committee on Appropriations, U.S. Senate, May 1, 2019, pp. 7 and 8, <https://www.appropriations.senate.gov/imo/media/doc/05.01.19--Richardson%20Testimony.pdf> (accessed July 14, 2021).
54. David B. Larter, "US Navy Halts Deliveries of Freedom-Class Littoral Combat Ship," *Defense News*, January 19, 2021, <https://www.defensenews.com/breaking-news/2021/01/19/the-us-navy-halts-deliveries-of-freedom-class-littoral-combat-ship/> (accessed July 13, 2021).
55. Ronald O'Rourke, "Navy Constellation (FFG-62) Class Frigate (Previously FFG[X]) Program: Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. R44972, updated February 11, 2021, p. 3, <https://crsreports.congress.gov/product/pdf/R/R44972/72> (accessed July 14, 2021).
56. Naval Surface Force Pacific Public Affairs, "Champion, Scout, Ardent Decommission After Distinguished Service," Commander, U.S. Pacific Fleet, August 20, 2020, <https://www.cpf.navy.mil/news.aspx/130710> (accessed July 14, 2021).
57. U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfare System Requirements—OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, March 2019, pp. 7 and 21, https://media.defense.gov/2020/May/18/2002302045/-1/-1/PB20_SHIPBUILDING_PLAN.PDF (accessed July 14, 2021).
58. Appendix 4, "Planned Decommissionings, Dismantlings, and Disposals," in U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities—OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, pp. 16–18, https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF (accessed July 14, 2021).
59. Paul McLeary, "Navy Unveils Surprise Plan for Littoral Combat Ships," *Breaking Defense*, April 29, 2021, <https://breakingdefense.com/2021/04/navy-unveils-surprise-plan-for-littoral-combat-ships/> (accessed July 12, 2021).
60. Megan Eckstein, "Fincantieri Wins \$795M Contract for Navy Frigate Program," U.S. Naval Institute News, April 30, 2020, <https://news.usni.org/2020/04/30/fincantieri-wins-795m-contract-for-navy-frigate-program> (accessed July 13, 2021).
61. Geurts, Kilby, and Smith, statement on "The Department of the Navy Fiscal Year 2021 Budget Request for Seapower and Projection Forces," p. 12.
62. Joe Gould and David B. Larter, "With a Second Frigate Yard Competition on the Horizon, Austal USA Moves to Add Steel Shipbuilding," *Defense News*, March 29, 2021, <https://www.defensenews.com/naval/2021/03/29/with-a-second-frigate-yard-competition-on-the-horizon-austal-usa-moves-to-add-steel-shipbuilding/> (accessed July 13, 2021).
63. Ronald O'Rourke, "Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. RL32665, June 3, 2020, p. 14, <https://crsreports.congress.gov/product/pdf/RL/RL32665/305> (accessed July 14, 2021).
64. General David H. Berger, "Force Design 2030," U.S. Marine Corps, March 2020, pp. 2 and 4, <https://www.hqmc.marines.mil/Portals/142/Docs/CMC38%20Force%20Design%202030%20Report%20Phase%20I%20and%20II.pdf?ver=2020-03-26-121328-460> (accessed July 14, 2021).

65. "The Future Naval Force Study is a collaborative OSD, Joint Staff and Department of the Navy effort to assess future naval force structure options and inform future naval force structure decisions and the 30-year shipbuilding plan," according to a Navy spokesman quoted in David B. Larter and Aaron Mehta, "The Pentagon Is Eyeing a 500-Ship Navy, Documents Reveal," *Defense News*, September 24, 2020, <https://www.defensenews.com/naval/2020/09/24/the-pentagon-is-eyeing-a-500-ship-navy-documents-reveal/> (accessed July 15, 2021). See also Ronald O'Rourke, "Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress," Congressional Research Service Report for Members and Committees of Congress No. RL32665, September 17, 2020, pp. 10 and 11, https://www.everycrsreport.com/files/2020-09-17_RL32665_c609d44928ddf6f859c2d347ac90c2ab90a813ed.pdf (accessed July 15, 2021).
66. Naval Sea Systems Command, "Naval Vessel Register: Ship Battle Forces," <https://www.nvr.navy.mil/NVRSHIPS/SHIPBATTLEFORCE.HTML> (accessed July 14, 2021).
67. Geurts, Kilby, and Smith, statement on "The Department of the Navy Fiscal Year 2021 Budget Request for Seapower and Projection Forces," p. 13.
68. Senate Armed Services Committee, "Fiscal Year 2021 National Defense Authorization Act," p. 10, <https://www.armed-services.senate.gov/imo/media/doc/FY%2021%20NDAA%20Summary.pdf> (accessed July 14, 2021).
69. Testimony of Kenneth J. Braithwaite, Secretary of the Navy, and Admiral Michael M. Gilday, Chief of Naval Operations, in stenographic transcript, *Hearing to Receive Testimony on Navy and Marine Corps Readiness*, Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate, December 2, 2020, pp. 84–87, https://www.armed-services.senate.gov/imo/media/doc/20-40_12-02-2020.pdf (accessed July 14, 2021).
70. Geurts, Kilby, and Smith, statement on "The Department of the Navy Fiscal Year 2021 Budget Request for Seapower and Projection Forces," p. 13.
71. Report No. 116-236, *National Defense Authorization Act for Fiscal Year 2021*, Report to Accompany S. 4049, To Authorize Appropriations for Fiscal Year 2021 for Military Activities of the Department of Defense, for Military Construction, and for Defense Activities of the Department of Energy, to Prescribe Military Personnel Strengths for Such Fiscal Year, and for Other Purposes, Committee on Armed Services, U.S. Senate, 116th Cong., 2nd Sess., June 24, 2020, p. 32, <https://www.congress.gov/116/crpt/srpt236/CRPT-116srpt236.pdf> (accessed July 14, 2021).
72. Table 1, "FYDP Funding for Unmanned Platforms," in U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities–OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, p. 4.
73. Jon Harper, "Navy Wants \$12 Billion for Unmanned Platforms," *National Defense*, May 26, 2020, [https://www.nationaldefensemagazine.org/articles/2020/5/26/navy-wants-\\$12-billion-for-unmanned-platforms](https://www.nationaldefensemagazine.org/articles/2020/5/26/navy-wants-$12-billion-for-unmanned-platforms) (accessed July 14, 2021).
74. U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities–OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022*, June 2021, https://s3.documentcloud.org/documents/20961220/pb22-shipbuilding-plan-june-2021_final.pdf (accessed July 14, 2021).
75. Sam LaGrone, "Navy Takes Delivery of Sea Hawk Unmanned Vessel," U.S. Naval Institute News, updated April 9, 2021, <https://news.usni.org/2021/04/08/navy-takes-delivery-of-sea-hawk-unmanned-vessel> (accessed July 14, 2021).
76. Sam LaGrone, "Ghost Fleet Ship 'Nomad' Transited Panama Canal, Headed to California," U.S. Naval Institute News, May 20, 2021, <https://news.usni.org/2021/05/20/ghost-fleet-ship-nomad-transited-panama-canal-headed-to-california> (accessed July 14, 2021).
77. Senate Armed Services Committee, "Fiscal Year 2021 National Defense Authorization Act," p. 10.
78. U.S. Department of the Navy, U.S. Navy, and U.S. Marine Corps, *Department of the Navy Unmanned Campaign Framework*, March 16, 2021, pp. 8–9, 15, 18, and 33–34, https://www.navy.mil/Portals/1/Strategic/20210315%20Unmanned%20Campaign_Final_LowRes.pdf (accessed July 14, 2021).
79. The Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition, and Lieutenant General Eric M. Smith, Deputy Commandant, Combat Development and Integration, and Commanding General, Marine Corps Combat Development Command, statement on "Marine Corps Ground Programs" before the Subcommittee on Seapower, Committee on Armed Services, U.S. Senate, March 11, 2020, p. 7, https://www.armed-services.senate.gov/imo/media/doc/Geurts-Smith_03-11-20.pdf (accessed July 14, 2021).
80. U.S. Navy, Office of Naval Research, Corporate Strategic Communications, "Unmanned Capabilities Front and Center During Naval Exercise," April 22, 2021, <https://www.navy.mil/Press-Office/News-Stories/Article/2582101/unmanned-capabilities-front-and-center-during-naval-exercise/> (accessed July 14, 2021).
81. Mallory Shelbourne, "Northrop Grumman Testing MQ-8C Expeditionary Controls for Marine, Navy Missions," U.S. Naval Institute News, May 25, 2021, https://news.usni.org/2021/05/25/northrop-grumman-testing-mq-8c-expeditionary-controls-for-marine-navy-missions?utm_source=USNI+News&utm_campaign=b212c864d9-USNI_NEWS_DAILY&utm_medium=email&utm_term=0_Odd4a1450b-b212c864d9-231849665&mc_cid=b212c864d9&mc_eid=1f01aea19e (accessed July 14, 2021).

82. Geurts, Kilby, and Smith, statement on “The Department of the Navy Fiscal Year 2021 Budget Request for Seapower and Projection Forces,” p. 14.
83. Team Ships Public Affairs, “Navy Accepts Delivery of USNS Newport,” Naval Sea Systems Command, September 3, 2020, <https://www.navsea.navy.mil/Media/News/SavedNewsModule/Article/2335817/navy-accepts-delivery-of-usns-newport/> (accessed July 14, 2021).
84. Hope Hodge Seck, “Speedy ‘Ambulance Ships’ a High Priority for Navy Medicine, Admiral Says,” *Military.com*, April 21, 2021, <https://www.military.com/daily-news/2021/04/21/speedy-ambulance-ships-high-priority-navy-medicine-admiral-says.html> (accessed July 14, 2021).
85. News release, “General Dynamics NASSCO Launches First Ship in the T-AO Fleet Oiler Program for the U.S. Navy,” General Dynamics NAASCO, January 13, 2021, <https://nassco.com/press-releases/general-dynamics-nassco-launches-first-ship-in-the-t-ao-fleet-oiler-program-for-the-u-s-navy/nggallery/page/2> (accessed July 14, 2021).
86. Appendix 4, “Planned Decommissionings, Dismantlings, and Disposals,” in U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities–OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, pp. 16–17.
87. Table, “Sec. 4101. Procurement,” in Report No. 116-617, *William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021*, Conference Report to Accompany H.R. 6395, U.S. House of Representatives, 116th Cong., 2nd Sess., December 3, 2020, p. 1058, <https://www.congress.gov/116/crpt/hrpt617/CRPT-116hrpt617.pdf> (accessed July 14, 2021); Table, “Sec. 4101. Procurement,” in *ibid.*, pp. 1956–1957; Table, “Sec. 401. Procurement,” in *ibid.*, p. 1067; and Table, “Sec. 4201. Research, Development, Test, and Evaluation,” in *ibid.*, p. 1090.
88. U.S. Department of Defense, Office of the Director, Operational Test and Evaluation, *Director, Operational Test and Evaluation FY 2020 Annual Report*, p. 177, <https://www.documentcloud.org/documents/20461160-2020doteannualreport> (accessed July 14, 2021).
89. Thomas Newdick and Tyler Rogoway, “F-15 Eagle Scores ‘Longest Known’ Air-to-Air Missile Shot During U.S. Air Force Test,” *The War Zone*, April 14, 2021, <https://www.thedrive.com/the-war-zone/40184/f-15-eagle-scores-longest-known-air-to-air-missile-shot-during-u-s-air-force-test> (accessed July 14, 2021).
90. The term “first island chain” refers to a string of archipelagoes in the Western Pacific ringing the Asia landmass in the East, stretching from the Kamchatka Peninsula in the North through Japan, Taiwan, Philippines, Malaysia, and Indonesia in the South.
91. The Honorable John C. Rood, Under Secretary of Defense for Policy, written testimony for hearing, *Strategic Threats, Ongoing Challenges, and National Defense Strategy Implementation*, Committee on Armed Services, U.S. Senate, December 5, 2019, p. 8, https://www.armed-services.senate.gov/imo/media/doc/Rood--Allvin_12-05-19.pdf (accessed July 14, 2021).
92. Table, “Sec. 4101. Procurement,” in Report No. 116-617, *William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021*, p. 1966.
93. Mallory Shelbourne, “First Image of Marines’ New Anti-Ship Missile Unmanned Truck Emerges,” *U.S. Naval Institute News*, April 28, 2021, <https://news.usni.org/2021/04/28/first-image-of-marines-new-anti-ship-missile-unmanned-truck-emerges> (accessed July 14, 2021).
94. The Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition ASN(RD&A); Lieutenant General Steven Rudder, Deputy Commandant for Aviation; and Rear Admiral Scott Conn, Director, Air Warfare, statement on “Department of the Navy Aviation Programs” before the Subcommittee on Seapower, Committee on Armed Services, U.S. Senate, April 10, 2019, p. 6, https://www.armed-services.senate.gov/imo/media/doc/Geurts_Rudder_Conn_04-10-19.pdf (accessed July 14, 2021).
95. Figure 4.3, “Aircraft Procurement Quantities and Total Funding,” in U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2021 Budget*, 2020, p. 4-6, https://www.secnv.navy.mil/fmc/fmb/Documents/21pres/Highlights_book.pdf (accessed July 12, 2021).
96. “Navy Warship Uses a New High-Energy Laser to Shoot down Drone in Mid-Flight,” May 24, 2020, <https://www.stripes.com/news/pacific/navy-warship-uses-a-new-high-energy-laser-to-shoot-down-drone-in-mid-flight-1.631053> (accessed July 12, 2021).
97. Xavier Vavasseur, “Lockheed Martin Delivers HELIOS Laser Weapon System to U.S. Navy,” *Naval News*, January 11, 2021, <https://www.navalnews.com/naval-news/2021/01/lockheed-martin-delivers-helios-laser-weapon-system-to-u-s-navy/> (accessed July 12, 2021).
98. Modly, Gilday, and Berger, statement “On Fiscal Year 2021 Department of the Navy Budget,” p. 28.
99. Andrew Eversden and David B. Larter, “Exclusive: Navy Transfers Network Authorities to Project Overmatch Office,” *C4ISRNET*, March 4, 2021, <https://www.c4isrnet.com/battlefield-tech/it-networks/2021/03/05/exclusive-navy-transfers-network-authorities-to-project-overmatch-office/> (accessed July 13, 2021).

100. Press briefing, “CNO Speaks at the United States Navy Memorial’s SITREP Speaker Series,” U.S. Navy, Office of Information, May 10, 2021, <https://www.navy.mil/Press-Office/Press-Briefings/display-pressbriefing/Article/2601826/cno-speaks-at-the-united-states-navy-memorials-sitrep-speaker-series/> (accessed July 13, 2021).
101. Testimony of Admiral John M. Richardson, Chief of Naval Operations, in stenographic transcript, *Hearing on the Posture of the Department of the Navy in Review of the Defense Authorization Request for Fiscal Year 2019 and the Future Years Defense Program*, Committee on Armed Services, U.S. Senate, April 19, 2018, pp. 91–92, https://www.armed-services.senate.gov/imo/media/doc/18-42_04-19-18.pdf (accessed July 14, 2021).
102. The Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition, and Vice Admiral Thomas Moore, Commander, Naval Sea Systems Command, statement on “Ship and Submarine Maintenance” before the Subcommittee on Seapower and Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate, December 4, 2019, pp. [1] and [8], https://www.armed-services.senate.gov/imo/media/doc/Geurts--Moore_12-04-19.pdf (accessed July 14, 2021).
103. Press briefing, “CNO Speaks at the United States Navy Memorial’s SITREP Speaker Series.”
104. *Ibid.*
105. Based on a review of all Navy messages from February 2020 to June 2021 in U.S. Navy, “U.S. Navy COVID-19 Updates,” <https://www.navy.mil/US-Navy-COVID-19-Updates/> (accessed July 13, 2021).
106. Cumulative numbers of Navy’s fully and partially vaccinated were calculated using a total of 347,487 active duty as of July 23, 2021. See U.S. Navy, “Our People Updated on July 23, 2021,” <https://www.navy.mil/About/Mission/> (accessed August 16, 2021). For numbers vaccinated, see U.S. Department of Defense, “Coronavirus: DOD Response: DOD Vaccination Administration to DOD Population,” <https://www.defense.gov/explore/spotlight/coronavirus/> (accessed August 16, 2021).
107. “Executive Summary to Naval Shipyard Recapitalization and Optimization Plan,” U.S. Naval Institute News, updated September 13, 2018, <https://news.usni.org/2018/09/12/executive-summary-to-naval-shipyard-recapitalization-and-optimization-plan> (accessed July 14, 2021).
108. Megan Eckstein, “NAVSEA: Navy Could Accelerate Some Public, Private Shipyard Upgrades If Money Were Available,” U.S. Naval Institute News, May 7, 2021, <https://news.usni.org/2021/05/07/navsea-navy-could-accelerate-some-public-private-shipyard-upgrades-if-money-were-available> (accessed July 13, 2021).
109. Press briefing, “CNO Speaks at the United States Navy Memorial’s SITREP Speaker Series.”
110. U.S. Department of Defense, Inspector General, (U) *Evaluation of the Readiness of the U.S. Navy’s P-8A Poseidon Aircraft to Meet the U.S. European Command’s Anti-Submarine Warfare Requirements*, Report No. DODIG-2021-083, May 19, 2021, pp. 19–22, https://assets.documentcloud.org/documents/20788182/dodig-2021-083_redacted.pdf (accessed July 13, 2021).
111. Congressional Budget Office, “The Capacity of the Navy’s Shipyards to Maintain Its Submarines,” March 2021, pp. 6–9, <https://www.cbo.gov/system/files/2021-03/57026-Shipyards.pdf> (accessed July 13, 2021).
112. U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, pp. 1-16 and 1-17, and U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, Department of the Navy Budget Card.
113. Modly, Gilday, and Berger, statement “On Fiscal Year 2021 Department of the Navy Budget,” p. 10.
114. Figure 4.7, “DON Flying Hour Program Funding,” in U.S. Navy, Office of Budget, *Highlights of the Department of the Navy FY 2022 Budget*, p. 4-7. See also pp. 4-8 and 4-9.
115. Modly, Gilday, and Berger, statement “On Fiscal Year 2021 Department of the Navy Budget,” pp. 11 and 25.
116. U.S. Indo-Pacific Command, unclassified “National Defense Authorization Act (NDAA) 2021 Section 1251 Independent Assessment: Executive Summary, U.S. Indo-Pacific Command’s Investment Plan, Pacific Deterrence Initiative, Fiscal Years 2022 and 2023–2027,” February 27, 2021, pp. 1 and 5.
117. Admiral Philip S. Davidson, U.S. Navy, Commander, U.S. Indo-Pacific Command, statement “On U.S. Indo-Pacific Command Posture” before the Committee on Armed Services, U.S. Senate, March 9, 2021, pp. 25–26, https://www.armed-services.senate.gov/imo/media/doc/Davidson_03-09-21.pdf (accessed July 12, 2021).
118. U.S. Navy, Fleet Forces Command, *Comprehensive Review of Recent Surface Force Incidents*, October 26, 2017, passim, <https://www.documentcloud.org/documents/4172114-Comprehensive-Review-of-Recent-Surface-Force> (accessed July 14, 2021).
119. U.S. Department of the Navy, *Strategic Readiness Review 2017*, p. 5, <http://s3.amazonaws.com/CHINFO/SRR+Final+12112017.pdf> (accessed July 12, 2021).