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China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress

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Committees of Congress

Summary

In an era of renewed great power competition, China's military modernization effort, including its naval modernization effort, has become the top focus of U.S. defense planning and budgeting. China's navy, which China has been steadily modernizing for more than 25 years, since the early to mid-1990s, has become a formidable military force within China's near-seas region, and it is conducting a growing number of operations in more-distant waters, including the broader waters of the Western Pacific, the Indian Ocean, and waters around Europe. China's navy is viewed as posing a major challenge to the U.S. Navy's ability to achieve and maintain wartime control of blue-water ocean areas in the Western Pacific—the first such challenge the U.S. Navy has faced since the end of the Cold War—and forms a key element of a Chinese challenge to the long-standing status of the United States as the leading military power in the Western Pacific.

China's naval modernization effort encompasses a wide array of platform and weapon acquisition programs, including anti-ship ballistic missiles (ASBMs), anti-ship cruise missiles (ASCMs), submarines, surface ships, aircraft, unmanned vehicles (UVs), and supporting C4ISR (command and control, communications, computers, intelligence, surveillance, and reconnaissance) systems. China's naval modernization effort also includes improvements in maintenance and logistics, doctrine, personnel quality, education and training, and exercises.

China's military modernization effort, including its naval modernization effort, is assessed as being aimed at developing capabilities for addressing the situation with Taiwan militarily, if need be; for achieving a greater degree of control or domination over China's near-seas region, particularly the South China Sea; for enforcing China's view that it has the right to regulate foreign military activities in its 200-mile maritime exclusive economic zone (EEZ); for defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf; for displacing U.S. influence in the Western Pacific; and for asserting China's status as the leading regional power and a major world power.

Consistent with these goals, observers believe China wants its navy to be capable of acting as part of a Chinese anti-access/area-denial (A2/AD) force—a force that can deter U.S. intervention in a conflict in China's near-seas region over Taiwan or some other issue, or failing that, delay the arrival or reduce the effectiveness of intervening U.S. forces. Additional missions for China's navy include conducting maritime security (including antipiracy) operations, evacuating Chinese nationals from foreign countries when necessary, and conducting humanitarian assistance/disaster response (HA/DR) operations.

The U.S. Navy in recent years has taken a number of actions to counter China's naval modernization effort. Among other things, the U.S. Navy has shifted a greater percentage of its fleet to the Pacific; assigned its most-capable new ships and aircraft and its best personnel to the Pacific; maintained or increased general presence operations, training and developmental exercises, and engagement and cooperation with allied and other navies in the Indo-Pacific; increased the planned future size of the Navy; initiated, increased, or accelerated numerous programs for developing new military technologies and acquiring new ships, aircraft, unmanned vehicles, and weapons; begun development of new operational concepts (i.e., new ways to employ Navy and Marine Corps forces) for countering Chinese maritime A2/AD forces; and signaled that the Navy in coming years will shift to a more-distributed fleet architecture that will feature a smaller portion of larger ships, a larger portion of smaller ships, and a substantially greater use of unmanned vehicles. The issue for Congress is whether the U.S. Navy is responding appropriately to China's naval modernization effort.

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Issue for Congress

This report provides background information and issues for Congress on China's naval modernization effort and its implications for U.S. Navy capabilities. (For an overview of China's military as a whole, see CRS Report R44196, *The Chinese Military: Overview and Issues for Congress*, by Ian E. Rinehart.)

In an era of renewed great power competition,[1] China's military modernization effort, including its naval modernization effort, has become the top focus of U.S. defense planning and budgeting.[2] The issue for Congress for this CRS report is whether the U.S. Navy is responding appropriately to China's naval modernization effort. Decisions that Congress reaches on this issue could affect U.S. and allied security, Navy capabilities and funding requirements, and the defense industrial base.

Sources and Terminology

This report is based on unclassified open-source information, such as the annual Department of Defense (DOD) report to Congress on military and security developments involving China,[3] a 2019 Defense Intelligence Agency (DIA) report on China's military power,[4] a 2015 Office of Naval Intelligence (ONI) report on China's navy,[5] published reference sources such as *IHS Jane's Fighting Ships*,[6] and press reports.

For convenience, this report uses the term China's naval modernization effort to refer to the modernization not only of China's navy, but also of Chinese military forces outside China's navy that can be used to counter U.S. naval forces operating in the Western Pacific, such as land-based anti-ship ballistic missiles (ASBMs), land-based surface-to-air missiles (SAMs), land-based Air Force aircraft armed with anti-ship cruise missiles (ASCMs), and land-based long-range radars for detecting and tracking ships at sea.

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[1] For further discussion of the shift to an era of renewed great power competition, see CRS Report R43838, *Renewed Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

[2] See, for example, Tom Rogan, "Defense Secretary Mark Esper: It's China, China, China," *Washington Examiner*, August 28, 2019; Melissa Leon and Jennifer Griffin, "Pentagon 'Very Carefully' Watching China, It's 'No. 1 Priority,' Defense Secretary Mark Esper Tells Fox News," *Fox News*, August 22, 2019; Missy Ryan and Dan Lamothe, "Defense Secretary Wants to Deliver on the Goal of Outpacing China. Can He Do It?" *Washington Post*, August 6, 2019; Sandra Erwin, "New Pentagon Chief Shanahan Urges Focus on China and 'Great Power Competition,' *Space News*, January 2, 2019; Ryan Browne, "New Acting Secretary of Defense Tells Pentagon 'to Remember China, China, China,'" *CNN*, January 2, 2019; Paul McCleary, "Acting SecDef Shanahan's First Message: 'China, China, China,'" *Breaking Defense*, January 2, 2019.

[3] Department of Defense, *Annual Report to Congress, Military and Security Developments Involving the People's Republic of China 2019*, May 12, 2019. Hereinafter *2019 DOD CMSD*.

[4] Defense Intelligence Agency, *China Military Power, Modernizing a Force to Fight and Win*, 2019, 125 pp. Hereinafter *2019 DIA CMP*.

[5] Office of Naval Intelligence, *The PLA Navy, New Capabilities and Missions for the 21st Century*, undated but released in April 2015, 47 pp.

[6] Unless otherwise indicated, shipbuilding program information in this report is taken from *IHS Jane's Fighting Ships 2018-2019*, and previous editions. Other sources of information on these shipbuilding programs may disagree regarding projected ship commissioning dates or other details, but sources present similar overall pictures regarding PLA Navy shipbuilding.

China's military is formally called the People's Liberation Army (PLA). Its navy is called the PLA Navy, or PLAN (also abbreviated as PLA[N]), and its air force is called the PLA Air Force, or PLAAF. The PLA Navy includes an air component that is called the PLA Naval Air Force, or PLANAF. China refers to its ballistic missile force as the PLA Rocket Force (PLARF).

This report uses the term *China's near-seas region* to refer to the Yellow Sea, East China Sea, and South China Sea—the waters enclosed by the so-called *first island chain*. The so-called *second island chain* encloses both these waters and the Philippine Sea that is situated between the Philippines and Guam.[7]

Background

Brief Overview of China's Naval Modernization Effort

Key overview points concerning China's naval modernization effort include the following:

- China's naval modernization effort, which forms part of a broader Chinese military modernization effort that includes several additional areas of emphasis,[8] has been underway for more than 25 years, since the early to mid-1990s, and has transformed China's navy into a much more modern and capable force. China's navy is a formidable military force within China's near-seas region, and it is conducting a growing number of operations in more-distant waters, including the broader waters of the Western Pacific, the Indian Ocean, and waters around Europe.
- China's navy is, by far, the largest of any country in East Asia, and within the past few years it has surpassed the U.S. Navy in numbers of battle force ships, meaning the types of ships that count toward the quoted size of the U.S. Navy. ONI states that at the end of 2020, China's will have 360 battle force ships, compared with a projected total of 297 for the U.S. Navy at the end of FY2020. ONI projects that China will have 400 battle force ships by 2025, and 425 by 2030.[9]
- China's naval ships, aircraft, and weapons are now much more modern and capable than they were at the start of the 1990s, and are now comparable in many respects to those of Western navies. ONI states that "Chinese naval ship design

[7] For a map showing the first and second island chains, see *2019 DIA CMP*, p. 32.

[8] Other areas of emphasis in China's military modernization effort include space capabilities, cyber and electronic warfare capabilities, ballistic missile forces, and aviation forces, as well as the development of emerging military-applicable technologies such as hypersonics, artificial intelligence, robotics and unmanned vehicles, directed-energy technologies, and quantum technologies. For an overview of China's military as a whole, see CRS Report R44196, *The Chinese Military: Overview and Issues for Congress*, by Ian E. Rinehart. For a discussion of advanced military technologies, see CRS In Focus IF11105, *Defense Primer: Emerging Technologies*, by Kelley M. Sayler.

U.S.-China competition in military capabilities in turn forms one dimension of a broader U.S.-China strategic competition that also includes political, diplomatic, economic, technological, and ideological dimensions.

[9] Source for China's number of battle force ships: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 3. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

and material quality is in many cases comparable to [that of] USN [U.S. Navy] ships, and China is quickly closing the gap in any areas of deficiency."[10]

- China's navy is viewed as posing a major challenge to the U.S. Navy's ability to achieve and maintain wartime control of blue-water ocean areas in the Western Pacific—the first such challenge the U.S. Navy has faced since the end of the Cold War. China's navy forms a key element of a Chinese challenge to the long-standing status of the United States as the leading military power in the Western Pacific.
- China's naval modernization effort encompasses a wide array of platform and weapon acquisition programs, including anti-ship ballistic missiles (ASBMs), anti-ship cruise missiles (ASCMs), submarines, surface ships, aircraft, unmanned vehicles (UVs), and supporting C4ISR (command and control, communications, computers, intelligence, surveillance, and reconnaissance) systems. China's naval modernization effort also includes improvements in maintenance and logistics, doctrine, personnel quality, education and training, and exercises.[11]
- China's military modernization effort, including its naval modernization effort, is assessed as being aimed at developing capabilities for addressing the situation with Taiwan militarily, if need be; for achieving a greater degree of control or domination over China's near-seas region, particularly the South China Sea; for enforcing China's view that it has the right to regulate foreign military activities in its 200-mile maritime exclusive economic zone (EEZ);[12] for defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf; for displacing U.S. influence in the Western Pacific; and for asserting China's status as the leading regional power and a major world power.
- Consistent with these goals, observers believe China wants its navy to be capable of acting as part of a Chinese anti-access/area-denial (A2/AD) force—a force that can deter U.S. intervention in a conflict in China's near-seas region over Taiwan or some other issue, or failing that, delay the arrival or reduce the effectiveness of intervening U.S. forces. Additional missions for China's navy include conducting maritime security (including antipiracy) operations, evacuating Chinese nationals from foreign countries when necessary, and conducting humanitarian assistance/disaster response (HA/DR) operations.
- Until recently, China's naval modernization effort appeared to be focused less on increasing total platform (i.e., ship and aircraft) numbers than on increasing the modernity and capability of Chinese platforms. Some categories of ships, however, are now increasing in number. The planned ultimate size and composition of China's navy is not publicly known. In contrast to the U.S. Navy, China does not release a navy force-level goal or detailed information about

[10] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 3. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[11] See, for example, Roderick Lee, "The PLA Navy's ZHANLAN Training Series: Supporting Offensive Strike on the High Seas," *China Brief*, April 13, 2020.

[12] For additional discussion, see CRS Report R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress*, by Ronald O'Rourke.

planned ship procurement rates, planned total ship procurement quantities, planned ship retirements, and resulting projected force levels.

- Although China's naval modernization effort has substantially improved China's naval capabilities in recent years, China's navy currently is assessed as having limitations or weaknesses in certain areas, including joint operations with other parts of China's military, antisubmarine warfare (ASW), long-range targeting, and a lack of recent combat experience. China is working to reduce or overcome such limitations and weaknesses.[13] Although China's navy has limitations and weaknesses, it may nevertheless be sufficient for performing missions of interest to Chinese leaders. As China's navy reduces its weaknesses and limitations, it may become sufficient to perform a wider array of potential missions.
- In addition to modernizing its navy, China in recent years has substantially increased the size of its coast guard.[14] China's coast guard is, by far, the largest of any country in East Asia. China also operates a sizeable maritime militia that includes a large number of fishing vessels. China relies primarily on its maritime militia and coast guard to assert and defend its maritime claims in its near-seas region, with the navy operating over the horizon as a potential backup force.[15]

Selected Elements of China's Naval Modernization Effort

This section provides a brief overview of elements of China's naval modernization effort that have attracted frequent attention from observers.

Anti-Ship Missiles

China reportedly is fielding two types of land-based ballistic missiles with a capability of hitting ships at sea—the DF-21D (**Figure 1**), a road-mobile anti-ship ballistic missile (ASBM) with a range of more than 1,500 kilometers (i.e., more than 910 nautical miles), and the DF-26 (**Figure 2**), a road-mobile, multi-role intermediate range ballistic missile (IRBM) with a maximum range of about 4,000 kilometers (i.e., about 2,160 nautical miles) that DOD says "is capable of conducting conventional and nuclear precision strikes against ground targets as well as conventional strikes against naval targets...."[16] China reportedly is also developing hypersonic glide vehicles that, if incorporated into Chinese ASBMs, could make Chinese ASBMs more difficult to intercept.[17]

[13] For example, China's naval shipbuilding programs were previously dependent on foreign suppliers for some ship components. ONI, however, states that "almost all weapons and sensors on Chinese naval ships are produced in-country, and China no longer relies on Russia or other countries for any significant naval ship systems." (Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, pp. 2-3. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.)

[14] For additional details, see *2019 DOD CMSD*, p. 53, and *2019 DIA CMP*, p. 78.

[15] For additional discussion, see CRS Report R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress*, by Ronald O'Rourke.

[16] *2019 DOD CMSD*, p. 44.

[17] See, for example, Christian Davenport, "Why the Pentagon Fears the U.S. Is Losing the Hypersonic Arms Race with Russia and China," *Washington Post*, June 8, 2018; Keith Button, "Hypersonic Weapons Race," *Aerospace America*, June 2018.

Figure 1. DF-21D Anti-Ship Ballistic Missile (ASBM)

Source: Photograph accompanying Andrew S. Erickson, "China's DF-21D Anti-Ship Ballistic Missile (ASBM)—Officially Revealed at 3 September Parade—Complete Open Source Research Compendium," AndrewErickson.com, September 10, 2015, accessed August 28, 2019.

Figure 2. DF-26 Multi-Role Intermediate-Range Ballistic Missile (IRBM)

Source: Photograph accompanying Missile Defense Project, "Dong Feng-26 (DF-26)," Missile Threat, Center for Strategic and International Studies, January 8, 2018, last modified January 15, 2019, accessed August 28, 2019.

Observers have expressed strong concerns about China's ASBMs, because such missiles, in combination with broad-area maritime surveillance and targeting systems, would permit China to attack aircraft carriers, other U.S. Navy ships, or ships of allied or partner navies operating in the Western Pacific. The U.S. Navy has not previously faced a threat from highly accurate ballistic missiles capable of hitting moving ships at sea. For this reason, some observers have referred to ASBMs as a "game-changing" weapon.

China's extensive inventory of anti-ship cruise missiles (ASCMs) includes both Russian- and Chinese-made designs, including some advanced and highly capable ones, such as the Chinese-made YJ-18 (**Figure 3**). Although China's ASCMs do not always receive as much press attention as China's ASBMs (perhaps because ASBMs are a more-recent development), observers are nevertheless concerned about them. As discussed later in this report, the relatively long ranges of certain Chinese ASCMs have led to concerns among some observers that the U.S. Navy is not moving quickly enough to arm U.S. Navy surface ships with similarly ranged ASCMs.

Figure 3. YJ-18 Anti-Ship Cruise Missile (ASCM)

Source: Photograph accompanying "YJ-18," Missile Defense Advocacy Alliance, undated, accessed August 28, 2019.

Submarines

China has been steadily modernizing its submarine force, and most of its submarines are now built to relatively modern Chinese and Russian designs. Qualitatively, China's newest submarines might not be as capable as Russia's newest submarines,[18] but compared to China's earlier submarines, which were built to antiquated designs, its newer submarines are much more capable.

[18] Observers have sometimes characterized Russia's submarines rather than China's as being the most capable faced by the U.S. Navy. See, for example, Joe Gould and Aaron Mehta, "US Could Lose a Key Weapon for Tracking Chinese and Russian Subs," *Defense News*, May 1, 2019; Dave Majumdar, "Why the U.S. Navy Fears Russia's Submarines," *National Interest*, October 12, 2018; John Schaus, Lauren Dickey, and Andrew Metrick, "Asia's Looming Subsurface Challenge," *War on the Rocks*, August 11, 2016; Paul McLeary, "Chinese, Russian Subs Increasingly Worrying the Pentagon," *Foreign Policy*, February 24, 2016; Dave Majumdar, "U.S. Navy Impressed with New Russian Attack Boat," *USNI News*, October 28, 2014.

Most of China's submarines are non-nuclear-powered attack submarines (SSs). China also operates a small number of nuclear-powered attack submarines (SSNs) and a small number of nuclear-powered ballistic missile submarines (SSBNs). The number of SSNs and SSBNs may grow in coming years, but the force will likely continue to consist mostly of SSs. DOD states that "The speed of growth of the submarine force has slowed and [the force] will likely grow to between 65 and 70 submarines by 2020."[19] DIA states that "By 2020 the submarine force probably will increase to about 70 submarines."[20] ONI states that "China's submarine force continues to grow at a low rate, though with substantially more-capable submarines replacing older units. Current expansion at submarine production yards could allow higher future production numbers." ONI projects that China's submarine force will grow from a total of 66 boats (4 SSBNs, 7 SSNs, and 55 SSs) in 2020 to 76 boats (8 SSBNs, 13 SSNs, and 55 SSs) in 2030.[21]

China's newest series-built SS design is the Yuan-class (Type 039) SS (**Figure 4**), its newest SSN class is the Shang-class (Type 093) SSN (**Figure 5**), and its newest SSBN class is the Jin (Type 094) class SSBN (**Figure 6**). ONI states that "nuclear submarines are solely produced at Huludao Shipyard and typically undergo two to four years of outfitting and sea-trials before becoming operational. Since 2006, eight nuclear submarines have reached IOC initial operational capability], for an average of one every 15 months…. Diesel-Electric submarines are produced at two shipyards and typically undergo approximately one year of outfitting and sea-trials before becoming operational."[22]

Figure 4.Yuan (Type 039) Attack Submarine (SS)

Source: Photograph accompanying "Type 039A Yuan class," SinoDefence.com, July 10, 2018, accessed August 28, 2019.

[19] *2019 DOD CMSD*, pp. 35-36.

[20] *2019 DIA CMP*, p. 72.

[21] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 1. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[22] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 3. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

Figure 5. Shang (Type 093) Attack Submarine (SSN)

Source: Photograph accompanying SinoDefence.com, "Type 093 Shang Class," July 1, 2018, accessed August 27, 2019, at http://sinodefence.com/type093_shang-class/.

Figure 6. *Jin* (Type 094) Ballistic Missile Submarine (SSBN)

Source: Photograph accompanying Minnie Chan, "China Puts a Damper on Navy's 70th Anniversary Celebrations As It Tries to Allay Fears Over Rising Strength," *South China Morning Post*, April 23, 2019. The article credits the photograph to Xinhua.

China's submarines are armed with one or more of the following: ASCMs, wire-guided and wake-homing torpedoes, and mines. Wake-homing torpedoes can be very difficult for surface ships to decoy. Each Jin-class SSBN is expected to be armed with 12 JL-2 nuclear-armed

submarine-launched ballistic missiles (SLBMs).[23] China reportedly is developing a new SLBM, called the JL-3, as a successor to the JL-2.[24]

Aircraft Carriers

Overview

China's first aircraft carrier, *Liaoning* (Type 001) (**Figure 7**), entered service in 2012. China's second aircraft carrier (and its first fully indigenously built carrier), *Shandong* (Type 001A) (**Figure 8**), entered service on December 17, 2019. China's third carrier, the Type 002 (**Figure 9**), is under construction; ONI expects it to enter service by 2024.[25] China's fourth carrier, reportedly also to be built to the Type 002 design, reportedly may begin construction as early as 2021.[26] The Type 002 carriers, like *Liaoning* and *Shandong*, are to be conventionally powered.

ONI states that "China has two shipyards expected to be used for aircraft carrier production, though several other large commercial yards could, in theory, also build carriers."[27] Observers have speculated that China may eventually field a force of four to six (or possibly more than six) aircraft carriers. In late November 2019, it was reported that the Chinese government, while deciding to proceed with the construction of the fourth carrier, had put on hold plans to build a fifth carrier, known as the Type 003, which was to be nuclear-powered, due to budgetary and technical considerations.[28] Observers expect that it will be some time before China masters carrier-based aircraft operations on a substantial scale.

Liaoning (Type 001)

Liaoning is a refurbished ex-Ukrainian aircraft carrier that China purchased from Ukraine in 1998 as an unfinished ship.[29] It is conventionally powered, has an estimated full load displacement of 60,000 to 66,000 tons, and reportedly can accommodate an air wing of 30 or more fixed-wing

[23] DOD estimates the range of the JL-2 at 7,400 km. Such a range could permit Jin-class SSBNs to attack targets in Alaska (except the Alaskan panhandle) from protected bastions close to China, targets in Hawaii (as well as targets in Alaska, except the Alaskan panhandle) from locations south of Japan, targets in the western half of the 48 contiguous states (as well as Hawaii and Alaska) from mid-ocean locations west of Hawaii, or targets in all 50 states from mid-ocean locations east of Hawaii.

[24] *2019 DOD CMSD*, p. 36.

[25] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[26] Minnie Chan, "Chinese Navy Set to Build Fourth Aircraft Carrier, but Plans for a More Advanced Ship Are Put on Hold," *South China Morning Post*, November 28, 2019.

[27] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[28] Minnie Chan, "Chinese Navy Set to Build Fourth Aircraft Carrier, but Plans for a More Advanced Ship Are Put on Hold," *South China Morning Post*, November 28, 2019. See also Steven Stashwick, "Technical Problems, Slowing Economy Cut China's Carrier Ambitions," *Diplomat*, December 4, 2019; Sebastien Roblin, "China Cancels Plans for Two Nuclear-Powered Super Aircraft Carriers," *National Interest*, December 7, 2019; Minnie Chan, "China's Navy is Being Forced to Rethink Its Spending Plans as Cost of Trade War Rises," *South China Morning Post*, May 26, 2019.

[29] Prior to the dissolution of the Soviet Union in December 1991, Ukraine was a part of the Soviet Union and the place where the Soviet Union built its aircraft carriers.

airplanes and helicopters, including 24 fighters. The *Liaoning* lacks aircraft catapults and instead launches fixed-wing airplanes off the ship's bow using an inclined "ski ramp."

Figure 7. *Liaoning* (Type 001) Aircraft Carrier

Source: Photograph accompanying China Power Team, "How Does China's First Aircraft Carrier Stack Up?" China Power (Center for Strategic and International Studies), December 9, 2015, updated December 14, 2018, accessed August 28, 2019.

Figure 8. *Shandong* (Type 001A) Aircraft Carrier

Source: Photograph accompanying Daniel Brown, "China's Newest Aircraft Carrier Is Actually Very Outdated — But Its Next One Should Worry the US Navy A Lot," *Business Insider*, July 18, 2018. The article credits the photograph to Reuters.

Figure 9. Type 002 Aircraft Carrier Under Construction

Source: Photograph accompanying China Power Team, "Tracking China's Third Aircraft Carrier," China Power. May 6, 2019, updated October 17, 2019, accessed November 18, 2019, at https://chinapower.csis.org/china-carrier-type-002/.

By comparison, U.S. Navy aircraft carriers are nuclear powered (giving them greater cruising endurance than a conventionally powered ship), have a full load displacement of about 100,000 tons, can accommodate air wings of 60 or more aircraft, including fixed-wing aircraft and some helicopters, and launch their fixed-wing aircraft over both their bows and their angled decks using catapults, which can give those aircraft a range/payload capability greater than that of aircraft launched with a ski ramp. The *Liaoning*, like U.S. Navy aircraft carriers, lands fixed-wing aircraft using arresting wires on its angled deck.

Some observers have referred to the *Liaoning* as China's "starter" carrier. China has been using *Liaoning* in part for pilot training. In May 2018, China reportedly announced that the aircraft carrier group formed around *Liaoning* had reached initial operational capability (IOC),[30] although that term might not mean the same as it does when used by DOD in connection with U.S. weapon systems.

Shandong (Type 001A)

Shandong is a modified version of the *Liaoning* design that incorporates some design improvements, including features that reportedly will permit it to embark and operate a larger air

[30] Andrew Tate, "Liaoning Carrier Group Reaches Initial Operational Capability, *IHS Jane's Defence Weekly*, June 4, 2018. See also Travis Fedschun, "China Says Carrier Group Reaches 'Initial' Combat Capability," *Fox News*, May 31, 2018; "China's First Aircraft Carrier Formation Capable of Systemic Combat Operation," CGTV.com, May 31, 2018; Global Times, "Chinese Aircraft Carrier Forming All-Weather Combat Capability with Successful Night Takeoff and Landing," *People's Daily Online*, May 29, 2018.

wing of 40 aircraft that includes 36 fighters.[31] Its displacement is estimated at 66,000 to 70,000 tons.

Type 002 Carriers

Press reports state that the Type 002 carrier, the start of whose construction was announced in the Chinese press in November 2018,[32] may have a displacement of 80,000 tons to 85,000 tons and that it will be equipped with electromagnetic catapults rather than a ski ramp, which will improve the range/payload capability of the fixed-wing aircraft that it operates.

Type 003 Carrier

A March 15, 2018, press report stated that following the Type 002 carrier design, China was to begin building a Type 003 carrier design that would displace 90,000 to 100,000 tons and, in addition to being equipped with electromagnetic catapults, be nuclear powered.[33] As mentioned above, in late November 2019, it was reported that the Chinese government had put on hold plans to build this Type 003 design.

Carrier-Based Aircraft

China's primary carrier-based fighter aircraft is the J-15 or Flying Shark (**Figure 10**), an aircraft derived from the Russian Su-33 Flanker aircraft design that can operate from carriers equipped with a ski ramp rather than catapults. China reportedly plans to develop a carrier-capable variant of its J-20 fifth-generation stealth fighter and/or a carrier-capable variant of its FC-31 fifth-generation stealth fighter to complement or succeed the J-15 on catapult-equipped Chinese carriers.[34] China reportedly is also developing a carrier-based stealth drone aircraft.[35]

Roles and Missions

Although aircraft carriers might have some value for China in Taiwan-related conflict scenarios, they are not considered critical for Chinese operations in such scenarios, because Taiwan is within range of land-based Chinese aircraft. Consequently, most observers believe that China is acquiring carriers primarily for their value in other kinds of operations, and to demonstrate China's status as a leading regional power and major world power. Chinese aircraft carriers could

[31] See, for example, Liu Xuanzun, "China's Second Aircraft Carrier Can Carry 50% More Fighter Jets Than Its First," *Global Times*, August 13, 2019; Liu Zhen, "China's New Aircraft Carrier to Pack More Jet Power Than the Liaoning," *South China Morning Post,* August 15, 2019.

[32] See, for example, Zhao Lei, "China Launches Work on Third Aircraft Carrier, Xinhia Says," *China Daily*, November 26, 2018; Liu Xuanzun (Global Times), "China's 3rd Aircraft Carrier Under Construction, to Be Equipped with New Technologies, *People's Daily Online*, November 27, 2018.

[33] Jeffrey Lin and P.W. Singer, "A Chinese Shipbuilder Accidentally Revealed Its Major Navy Plans," *Popular Science*, March 15, 2018.

[34] See Caleb Larson, "FC-31: China's Next Carrier Jet is Stolen and Stealthy," *National Interest*, April 18, 2020; Sebastien Roblin, "China's New Aircraft Carriers Are Getting Stealth Fighters," *National Interest*, October 26, 2019; Rick Joe, "Beyond China's J-20 Stealth Fighter," *Diplomat*, September 20, 2019; Minnie Chan, "China's Navy 'Set to Pick J-20 Stealth Jets for Its Next Generation Carriers,'" *South China Morning Post*, August 27, 2019.

[35] Minnie Chan, "China to Deploy Sharp Sword Stealth Drone for New Type 001A Aircraft Carrier," *South China Morning Post*, September 17, 2019.

be used for power-projection operations, particularly in scenarios that do not involve opposing U.S. forces, and to impress or intimidate foreign observers.[36]

Figure 10. J-15 Flying Shark Carrier-Capable Fighter

Source: Photograph accompanying "China Developing Elite New Variants of the J-15 Flying Shark to Deploy from EMALS Equipped Future Carriers; Implications for the Balance of Power at Sea," *Military Watch Magazine*, August 17, 2018, accessed August 28, 2019.

Chinese aircraft carriers could also be used for humanitarian assistance and disaster relief (HA/DR) operations, maritime security operations (such as antipiracy operations), and noncombatant evacuation operations (NEOs). Politically, aircraft carriers could be particularly valuable to China for projecting an image of China as a major world power, because aircraft carriers are viewed by many as symbols of major world power status. In a combat situation involving opposing U.S. naval and air forces, Chinese aircraft carriers would be highly vulnerable to attack by U.S. ships and aircraft, but conducting such attacks could divert U.S. ships and aircraft from performing other missions in a conflict situation with China.

Surface Combatants

China since the early 1990s has put into service numerous new classes of indigenously built surface combatants, including a new cruiser (or large destroyer), several classes of destroyers and frigates, a new class of corvettes (i.e., light frigates), and a new class of missile-armed patrol craft. These new classes of surface combatants demonstrate a significant modernization of PLA Navy surface combatant technology. DOD states that China's navy "remains engaged in a robust surface combatant construction program, producing new guided-missile cruisers (CG), guided-missile destroyers (DDG), and guided-missile frigates (FFG) which will significantly upgrade the

[36] For a discussion, see, for example, Bryan McGrath and Seth Cropsey, "The Real Reason China Wants Aircraft Carriers, China's Carrier Plans Target U.S. Alliances, Not Its Navy," *Real Clear Defense* (*www.realcleardefense.com*), April 10, 2014; Sebastien Roblin, "All of the Reasons Why the World Should Fear China's Aircraft Carriers," *National Interest,* October 24, 2017.

PLAN's air defense, anti-ship, and anti-submarine capabilities."[37] DIA states that "the era of past designs has given way to production of modern multimission destroyer, frigate, and corvette classes as China's technological advancement in naval design has begun to approach a level commensurate with, and in some cases exceeding, that of other modern navies."[38]

China is building a new class of cruiser (or large destroyer), called the Renhai-class or Type 055 (**Figure 11**), that reportedly displaces between 10,000 and 13,000 tons. By way of comparison, the U.S. Navy's Ticonderoga (CG-47) class cruisers and Arleigh Burke (DDG-51) class destroyers (aka the U.S. Navy's Aegis cruisers and destroyers) displace about 10,100 tons and 9,300 tons, respectively, while the U.S. Navy's three Zumwalt (DDG-1000) class destroyers displace about 15,600 tons.

Figure 11. *Renhai* (Type 055) Cruiser (or Large Destroyer)

Source: Photograph accompanying Kyle Mizokami, "Can the U.S. Navy Beat China's New Type 055 Destroyer In a Fight?" *National Interest*, September 29, 2019.

ONI states that Type 055 ships are being built by two shipyards, and that multiple ships in the class are currently under construction.[39] The first Type 055 ship was reportedly commissioned into service on January 12, 2020, and the sixth was reportedly launched (i.e., put into the water for the final stages of construction) in December 2019.[40]

[37] *2019 DOD CMSD*, p. 36.

[38] *2019 DIA CMP*, p. 70.

[39] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[40] Kristin Huang, "China Steps Up Warship Building Programme as Navy Looks to Extend Its Global Reach," *South China Morning Post*, December 31, 2019. See also Liu Xuanzun, "Chinese Navy Commissions First Type 055

China since the early 1990s has put into service multiple new classes of indigenously built destroyers, the most recent of which is the Luyang III (Type 052D) class (**Figure 12**), which displaces about 7,500 tons and is equipped with phased-array radars and vertical launch missile systems that outwardly are broadly similar to those on U.S. Navy cruisers and destroyers. Type 052D ships have been in serial production for some time, and the 23rd such ship was reportedly launched in December 2019.[41]

Figure 12. *Luyang III* (Type 052D) Destroyer

Source: Photograph accompanying "Type 052D Luyang-III Class," SinoDefence.com, September 3, 2017, accessed August 28, 2019.

China since the early 1990s has also put into service multiple new classes of indigenously built frigates, the most recent of which is the Jiangkai II (Type 054A) class (**Figure 13**), which displaces about 4,000 tons. ONI states that 30 Type 054As entered service between 2008 and 2019, and that no additional Type 054As are currently under construction.[42]

Destroyer," *Global Times*, January 12, 2020. Another press report states that eight Type 055 ships are expected to enter service over the next four years, and that more than two dozen such ships might be in service by the late 2020s. (Franz-Stefan Gady, "China's Navy Commissions First-of-Class Type 055 Guided Missile Destroyer," *Diplomat*, January 13, 2020.)

[41] Kristin Huang, "China Steps Up warship Building Programme as Navy Looks to Extend Its Global Reach," *South China Morning Post*, December 31, 2019.

[42] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

Figure 13. *Jiangkai II* (Type 054A) Frigate

Source: Chinese Military Review, "Type 054A (Jiangkai II class) FFG-546 Yancheng Guided Missile Frigate in Mediterranean," undated (but with a URL suggesting that it was posted in February of 2014), accessed August 29, 2018.

Figure 14. *Jingdao* (Type 056) Corvette

Source: Chinese Military Review, "Random Images of Chinese Type 056 Jiangdao Class Light Corvette," undated (but with a URL suggesting that it was posted in October 2013), accessed August 29, 2018.

China is also building a new type of corvette (i.e., a light frigate, or FFL) called the Jiangdao class or Type 056 (**Figure 14**), which displaces about 1,500 tons. Type 056 ships are being built at a high annual rate in four shipsyards. The first was commissioned in 2013. DOD states that "more than 40 of these corvettes entered service by the end of 2018, and more than a dozen more are currently under construction or outfitting."[43] The 42nd and 43rd were reportedly commissioned into service in December 2019.[44] ONI states that as of February 2020, more than 50 had entered service and another 15 were under construction.[45]

Amphibious Ships

China's new *Yuzhao* or Type 071 amphibious ships (**Figure 15**) have an estimated displacement of more than 19,855 tons,[46] compared to about 25,900 tons for the U.S. Navy's new San Antonio (LPD-17) class amphibious ships. The fifth Type 071 ship was reportedly commissioned into service in September 2018, and at least two more reportedly are under construction.

On September 25, 2019, China launched (i.e., put into the water for the final stages of its construction) the first of a new type of amphibious assault ship[47] called the Type 075 (**Figure 16**, **Figure 17**, and **Figure 18**) that has an estimated displacement of 30,000 to 40,000 tons, compared to 41,000 to 45,000 tons for U.S. Navy LHA/LHD-type amphibious assault ships.[48] On April 22, 2020, China launched the second ship in the class.[49] ONI states that as of February 2020, three Type 075s, including the first one, were under construction.[50]

Although larger amphibious ships such as the Type 071 and Type 075 would be of value for conducting amphibious landings in Taiwan-related conflict scenarios, some observers believe that China is building such ships as much for their value in conducting other operations, such as operations for asserting and defending China's claims in the South and East China Seas,

[43] *2019 DOD CMSD*, p. 36.

[44] Franz-Stefan Gady, "China's People Liberation Army Navy Commissions 42nd and 43rd Type 056/056A Corvettes," Diplomat, December 19, 2019.

[45] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[46] Unless otherwise indicated, displacement figures cited in this report are full load displacements. *IHS Jane's Fighting Ships 2017-2018*, p. 156, does not provide a full load displacement for the Type 071 class design. Instead, it provides a standard displacement of 19,855 tons. Full load displacement is larger than standard displacement, so the full load displacement of the Type 071 design is more than 19,855 tons.

[47] Amphibious assault ships, also referred to as helicopter carriers or (in British parlance) commando carriers, look like medium-sized aircraft carriers. U.S. Navy amphibious assault ships are designated LHA or LHD.

[48] See, for example, Rick Joe, "The Future of China's Amphibious Assault Fleet," *Diplomat,* July 17, 2019; Sebastien Roblin, "Bad News: China is Building Three Huge Helicopter 'Aircraft Carriers,'" *National Interest*, July 27, 2019; Tyler Rogoway, "China's New Amphibious Assault Ship Is A Monster," *The Drive*, August 22, 2019; Mike Yeo, "Photos Reveal Progress on China's Largest Amphibious Assault Ship," Defense News, August 23, 2019.

[49] Liu Zhen, "China Launches Second Type 075 Amphibious Helicopter Assault Ship," *South China Morning Post,* April 23, 2020; Elizabeth Shim, "China Launches Second Type 075 Assault Ship," *UPI,* April 22, 2020; Caleb Larson, "China Just Launched Their Second Type 075 Assault Carrier—Here's Why Everyone Is Worried," *National Interest,* April 22, 2020; Andrew Tate, "China's Second Type 075 Amphibious Assault Ship Launched in Shanghai," *Jane's*, April 22, 2020.

[50] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

humanitarian assistance/disaster relief (HA/DR) operations, maritime security operations (such as antipiracy operations), and noncombatant evacuation operations (NEOs). Politically, amphibious ships can also be used for naval diplomacy (i.e., port calls and engagement activities) and for impressing or intimidating foreign observers.[51]

Figure 15. *Yuzhao* (Type 071) Amphibious Ship

Source: Chinese Military Review, "Jinggang Shan (999) Type 071 YUZHAO Class Amphibious Transport Dock," undated (but with a URL suggesting that it was posted in February 2012), accessed August 29, 2018.

Figure 16. Type 075 Amphibious Assault Ship

Source: Photograph accompanying David Axe, "China Is Finishing Its First Large Helicopter Assault Ship," *National Interest*, October 29, 2019.

[51] See, for example, Grant Newsham, "China's Amphibious Force Emerges," *Asia Times*, November 5, 2019.

Figure 17. Type 075 Amphibious Assault Ship

Source: Photograph accompanying David Axe, "Meet the Type 075 LHD: China's New Assault Ship," *National Interest*, December 11, 2019.

Operations Away from Home Waters

Although China's navy operates primarily in China's home waters, Chinese navy ships are conducting increasing numbers of operations away from China's home waters, including the broader waters of the Western Pacific, the Indian Ocean, and the waters surrounding Europe, including the Mediterranean Sea and the Baltic Sea. A November 23, 2019, DOD news report quoted Admiral Philip Davidson, the commander of the U.S. Indo-Pacific Command, as stating that China's navy had conducted more global naval deployments in the past 30 months than it had in the previous 30 years.[52]

While many of China's long-distance naval deployments have been for making diplomatic port calls, some of them have been for other purposes, including conducting training exercises and carrying out antipiracy operations in waters off Somalia. China has been conducting antipiracy operations in waters off Somalia since December 2008 via a succession of more than 30 rotationally deployed naval escort task forces.

[52] David Vergun, "Freedom of Navigation in South China Sea Critical to Prosperity, Says Indo-Pacific Commander," *DOD News*, November 23, 2019.

Figure 18. Type 075 Amphibious Assault Ship

Source: Photograph accompanying Joseph Trevithick and Tyler Rogoway, "China Just Launched Its Huge And Incredibly Quickly Built Amphibious Assault Ship," *The Drive*, September 25, 2019. The caption to the photograph credits the photograph to "Chinese internet."

Numbers of Ships; Comparisons to U.S. Navy

The planned ultimate size and composition of China's navy is not publicly known. The U.S. Navy makes public its force-level goal and regularly releases a 30-year shipbuilding plan that shows planned procurements of new ships, planned retirements of existing ships, and resulting projected force levels, as well as a five-year shipbuilding plan that shows, in greater detail, the first five years of the 30-year shipbuilding plan.[53] In contrast, China does not release a navy force-level goal or detailed information about planned ship procurement rates, planned total ship procurement quantities, planned ship retirements, and resulting projected force levels. It is

[53] For more information on the U.S. Navy's force-level goal, 30-year shipbuilding plan, and five-year shipbuilding plan, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

possible that the ultimate size and composition of China's navy is an unsettled and evolving issue even among Chinese military and political leaders.

Table 1 shows numbers of certain types of Chinese navy ships from 2005 to the present (and the number of China coast guard ships from 2017 to the present) as presented in DOD's annual reports on military and security developments involving China. DOD states that China's navy "is the region's largest navy, with more than 300 surface combatants, submarines, amphibious ships, patrol craft, and specialized types."[54] DIA states that "although the overall inventory has remained relatively constant, the PLAN is rapidly retiring older, single-mission warships in favor of larger, multimission ships equipped with advanced antiship, antiair, and antisubmarine weapons and sensors and C2 [command and control] facilities."[55]

As can be seen in **Table 1**, about 65% of the increase since 2005 in the number of Chinese navy ships shown in the table (a net increase of 77 ships out of a total net increase of 119 ships) resulted from increases in missile-armed fast patrol craft starting in 2009 (a net increase of 35 ships) and corvettes starting in 2014 (42 ships). These are the smallest surface combatants shown in the table. The net 35-ship increase in missile-armed fast patrol craft was due to the construction between 2004 and 2009 of 60 new *Houbei* (Type 022) fast attack craft[56] and the retirement of 25 older fast attack craft that were replaced by Type 022 craft. The 42-ship increase in corvettes is due to the *Jingdao* (Type 056) corvette program discussed earlier. ONI states that "a significant portion of China's Battle Force consists of the large number of new corvettes and guided-missile frigates recently built for the PLAN."[57]

As can also be seen in the table, most of the remaining increase since 2005 in the number of Chinese navy ships shown in the table is accounted for by increases in destroyers (12 ships), frigates (11 ships), and amphibious ships (17 ships). Most of the increase in frigates occurred in the earlier years of the table; the number of frigates has changed little in the later years of the table.

Table 1 lumps together less-capable older Chinese ships with more-capable modern Chinese ships. Thus, in examining the numbers in the table, it can be helpful to keep in mind that for many of the types of Chinese ships shown in the table, the percentage of the ships accounted for by more-capable modern designs was growing over time, even if the total number of ships for those types was changing little.

For reference, **Table 1** also shows the total number of ships in the U.S. Navy (known technically as the total number of battle force ships), and compares it to the total number of Chinese ships shown in the table. The result is an apples-vs.-oranges comparison, because the Chinese figure excludes certain ship types, such as auxiliary and support ships, while the U.S. Navy figure includes auxiliary and support ships but excludes patrol craft.

[54] *2019 DOD CMSD*, p. 35. A similar statement is in *2019 DIA CMP*, p. 63.

[55] *2019 DIA CMP*, p. 69.

[56] The Type 022 program was discussed in the August 1, 2018, version of this CRS report, and earlier versions.

[57] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

Table 1. Numbers of Certain Types of Ships Since 2005

(Figures include both less-capable older units and more-capable newer units)

Year of DOD report	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019 change from 2005
Ballistic missile submarines	1	1	1	1	2	2	2	2	3	3	4	4	4	4	4	+3
Nuclear-powered attack submarines	6	5	5	5	6	6	5	5	5	5	5	5	5	5	6	0
Diesel attack submarines	51	50	53	54	54	54	49	48	49	51	53	57	54	47	50	-1
Aircraft carriers	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	+1
Destroyers	21	25	25	29	27	25	26	26	23	24	21	23	31	28	33	+12
Frigates	43	45	47	45	48	49	53	53	52	49	52	52	56	51	54	+11
Corvettes	0	0	0	0	0	0	0	0	0	8	15	23	23	28	42	+42
Missile-armed coastal patrol craft	51	45	41	45	70	85	86	86	85	85	86	86	88	86	86	+35
Amphibious ships: LSTs and LPDs	20	25	25	26	27	27	27	28	29	29	29	30	34	33	37	+17
Amphibious ships: LSMs	23	25	25	28	28	28	28	23	26	28	28	22	21	23	22	-1
Total of types above (does not include other types, such as auxiliary and support ships)	**216**	**221**	**222**	**233**	**262**	**276**	**276**	**271**	**273**	**283**	**294**	**303**	**317**	**306**	**335**	**+119**
China Coast Guard ships	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*185*	*240*	*248*	*n/a*
Total U.S. Navy battle force ships (which includes auxiliary and support ships but excludes patrol craft)	291	282	281	279	282	285	288	284	287	285	289	271	275	279	286	-5
U.S. Navy figure compared to above total for certain Chinese ship types	+75	+61	+59	+46	+20	+9	+12	+13	+14	+2	-5	-32	-42	-27	-49	-124

Source: Table prepared by CRS based on 2005-2019 editions of annual DOD report to Congress on military and security developments involving China (known for 2009 and prior editions as the report on China military power), and (for U.S. Navy ships) U.S. Navy data as presented in CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

Notes: n/a means data not available in report. **LST** means tank landing ship; **LPD** means transport dock ship; **LSM** means medium landing ship. The DOD report generally covers events of the prior calendar year. Thus, the 2019 edition covers events during 2018, and so on for earlier years. Similarly, for the U.S. Navy figures, the 2019 column shows the figure for the end of FY2018, and so on for earlier years.

Table 2 shows comparative numbers of Chinese and U.S. battle force ships. Battle force ship are the types of ships that count toward the quoted size of the Navy. For China, the battle force ships total excludes the missile-armed coastal patrol craft shown in **Table 1**, but includes auxiliary and support ships that are not shown in **Table 1**. Compared to the comparison shown in **Table 1**, the comparison **Table 2** is closer to being an apples-to-apples comparison of the two navies' numbers of ships. Even so, it is important to keep in mind the differences in composition between the two navies. The U.S. Navy, for example, has many more aircraft carriers, nuclear-powered submarines, and cruisers and destroyers, while China's navy has many more diesel attack submarines, frigates, and corvettes.

Table 2. Numbers of Battle Force Ships, 2000-2030

Figures include both less-capable older units and more-capable newer units

	2000	2005	2010	2015	2020	2025	2030
Ballistic missile submarines	1	1	3	4	4	6	8
Nuclear-powered attack submarines	5	4	5	6	7	10	13
Diesel attack submarines	56	56	48	53	55	55	55
Aircraft carriers, cruisers, destroyers	19	25	25	26	43	55	65
Frigates, corvettes	38	43	50	74	102	120	135
Total China navy battle force ships, including types not shown above	**110**	**220**	**220**	**255**	**360**	**400**	**425**
Total U.S. Navy battle force ships	***318***	***282***	***288***	***271***	***297***	***n/a***	***n/a***

Source: Table prepared by CRS. Source for China's navy: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, 4 pp. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission. Figures are for end of calendar year. Source for figures for U.S. Navy: U.S. Navy data; figures are for end of fiscal year.

Note: n/a means not available.

Relative U.S. and Chinese naval capabilities are sometimes assessed by showing comparative numbers of U.S. and Chinese ships. Although the total number of ships in a navy (or its aggregate tonnage) is relatively easy to calculate, it is a one-dimensional measure that leaves out numerous other factors that bear on a navy's capabilities and how those capabilities compare to its assigned missions. As a result, as discussed in further detail in **Appendix A**, comparisons of the total numbers of ships in the PLAN and the U.S. Navy are highly problematic as a means of assessing relative U.S. and Chinese naval capabilities and how those capabilities compare to the missions assigned to those navies. At the same time however, an examination of *the trends over time in the relative numbers of ships* can shed some light on how the relative balance of U.S. and Chinese naval capabilities might be changing over time.

U.S. Navy Response

The U.S. Navy in recent years has taken a number of actions to counter China's naval modernization effort. Among other things, the U.S. Navy has

- shifted a greater percentage of its fleet to the Pacific;[58]

[58] Efforts in this regard began at least as far back as 2006: The final report on the 2006 Quadrennial Defense Review

- assigned its most capable new ships and aircraft and its best personnel to the Pacific;
- maintained or increased general presence operations, training and developmental exercises, and engagement and cooperation with allied and other navies in the Indo-Pacific;
- increased the planned future size of the Navy;
- initiated, increased, or accelerated numerous programs for developing new military technologies and acquiring new ships, aircraft, unmanned vehicles, and weapons;
- begun development of new operational concepts (i.e., new ways to employ Navy and Marine Corps forces) for countering Chinese maritime A2/AD forces; and
- signaled that the Navy in coming years will shift to a more distributed fleet architecture that will feature a smaller portion of larger ships, a larger portion of smaller ships, and a substantially greater use of unmanned vehicles.

U.S. Navy efforts to increase cooperation with naval forces from allies and other countries such as Japan, Australia, and India appear aimed in part at expanding existing bilateral forms of naval cooperation (e.g., U.S.-Japan, U.S.-Australia, U.S.-India) into trilateral (e.g., U.S.-Japan-Australia, U.S.-Australia-India) or quadrilateral (U.S.-Japan-Australia-India) forms that could support the Trump Administration's overarching security and foreign policy construct for the Indo-Pacific region, called the Free and Open Indo-Pacific (FOIP).[59]

The increase in the planned size of the Navy is detailed in detail in another CRS report.[60]

Many of the Navy's programs for acquiring highly capable ships, aircraft, and weapon systems can be viewed as intended, at least in part, at improving the U.S. Navy's ability to counter Chinese maritime A2/AD capabilities. Examples of new technologies being developed by the Navy that might be of value in countering Chinese maritime A2/AD capabilities include large unmanned vehicles,[61] lasers, the electromagnetic rail gun (EMRG), and the gun-launched guided projectile (aka hypervelocity projectile).[62]

Navy and Marine Corps efforts to develop new operational concepts such as Distributed Maritime Operations (DMO) and Expeditionary Advanced Base Operations (EABO), and to shift to a more distributed fleet architecture, are discussed in detail in other CRS reports.[63]

(QDR) directed the Navy "to adjust its force posture and basing to provide at least six operationally available and sustainable carriers and 60% of its submarines in the Pacific to support engagement, presence and deterrence." (U.S. Department of Defense, *Quadrennial Defense Review Report*. Washington, 2006. February 6, 2006, p. 47.) Subsequent to this directive, the Navy announced an intention to increase to 60% (from a starting point of about 55%) the percentage of the fleet as a whole that is assigned to the Pacific.

[59] For more on the FOIP, see CRS Report R45396, *The Trump Administration's "Free and Open Indo-Pacific": Issues for Congress*, coordinated by Bruce Vaughn.

[60] See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[61] For more on these efforts, see CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

[62] For more on these efforts, see CRS Report R44175, *Navy Lasers, Railgun, and Gun-Launched Guided Projectile: Background and Issues for Congress*, by Ronald O'Rourke.

[63] See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke, and CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

Issues for Congress

Overview

The overall issue for Congress is whether the U.S. Navy is responding appropriately to China's naval modernization effort. Within this overall issue, specific issues include the following:

- the current and potential future U.S.-China balance of naval power in general, and in specific geographic areas, particularly the South China Sea;
- whether the planned size of the Navy will be appropriate for countering China's naval modernization effort in coming years while also permitting the Navy to perform other missions, including countering Russian military forces and defending U.S. interests in the Middle East;
- whether the Navy should shift to a more-distributed fleet architecture so as to improve the Navy's ability to avoid and withstand attack from Chinese maritime A2/AD forces—and if so, what that new architecture should look like, and how quickly the Navy should shift to it;
- whether the Navy is doing enough to
  - improve its ability to counter China's ASBMs or some of China's other maritime A2/AD weapons, such as its wake-homing torpedoes;
  - develop and procure new ASCMs with ranges that match or exceed those of China's longer-ranged ASCMs;
  - increase the operating range of Navy carrier air wings, so as to improve the ability of carriers and their air wings to achieve effects while operating at longer distances from Chinese ASBMs and other A2/AD weapons; and
- whether Congress should modify acquisition policies or the metrics for judging the success of acquisition programs so as to facilitate faster development of new technologies and weapons for the Navy—and if so, how those policies or metrics should be modified.

Discussion

Regarding the U.S.-China balance of naval power in general, U.S. and other observers generally assess that while the United States today has more naval capability overall, China's naval modernization effort since the 1990s has substantially reduced the U.S. advantage, and that if current U.S. and Chinese naval capability trend lines (such as those shown in **Table 1** and **Table 2**) do not change, China might eventually draw even with or surpass the United States in overall naval capability.

Regarding the current U.S.-China naval balance of power specifically in the South China Sea, some observers are concerned that China has already drawn even with or even surpassed the United States. U.S. Navy Admiral Philip Davidson, in responses to advance policy questions from the Senate Armed Services Committee for an April 17, 2018, hearing before the committee to consider nominations, including Davidson's nomination to become Commander, U.S. Pacific Command (PACOM),[64] stated that "China is now capable of controlling the South China Sea in

[64] The name of the command has since been changed to the U.S. Indo-Pacific Command (INDOPACOM).

all scenarios short of war with the United States."[65] A January 18, 2020, press report quotes James Kraska of the Naval War College as stating that "the US has lost advantage throughout the spectrum of operations, from low-level interaction against China's maritime militia to higher-end conflict scenarios," and that "in other words, China has escalation dominance, because it has the power to deter any US turn towards escalation. The US is outmatched in all of the scenarios."[66]

Skeptics of assessments like those above might argue that they do not give adequate weight to relative U.S. strengths (and corresponding Chinese relative weaknesses and limitations) in areas such as undersea warfare; personnel quality, training, and initiative; operational experience (particularly in combat situations); joint operations with other U.S. military services; and potential support from allies and partners, particularly Japan and Australia.

The above-listed issues of the planned size of the Navy and the shift to a more-distributed fleet architecture are discussed in detail in other CRS reports.[67] The issue of the Navy's ability to counter China's ASBMs is discussed in detail in this report in **Appendix B**. The issue of the Navy's ability to counter wake-homing torpedoes may have been made more pressing by the reportedly poor performance of an anti-torpedo torpedo that the Navy was developing as a means for Navy surface ships to counter hard-to-decoy wake-homing torpedoes and other torpedoes. The Navy now reportedly plans to remove the anti-torpedo torpedo system from the ships that were equipped with it.[68]

The Navy in recent years has initiated efforts to develop and procure longer-ranged ASCMs, but some observers have expressed frustration that these efforts are not moving quickly enough.[69] In support of its efforts, the Navy testified in March 2020 that

> The Navy's offensive strike systems consist of a broad family of current and future weapons that together can and will strike from the sea, air, and land. These weapons capitalize on key system attributes (e.g. speed, range, lethality, survivability, and commonality) with a strong focus on delivering 'multi-domain' capabilities. The [Navy] Department's Offensive Missile Strategy (OMS) supports a wider, more systematic approach towards delivering offensive weapons balance to increase overall force effectiveness to address emerging threats.
>
> Our current OMS construct has three pillars. First, the Department will sustain relevant weapon systems. Our objective is to preserve the readiness and capacity of our key strike weapons inventories. Second, the Department will pursue strike weapon capability enhancements. Under this initiative, the Navy will develop near-term capability upgrades to enhance existing weapons that provide critical improvements to our current long-range

[65] Advance Policy Questions for Admiral Philip Davidson, USN Expected Nominee for Commander, U.S. Pacific Command, p. 18. See also pp. 8. 16. 17. 19, and 43.

[66] John Power, "Has the US Already Lost the Battle for the South China Sea?" *South China Morning Post*, January 18, 2020. See also Gregory B. Poling, "The Conventional Wisdom on China's Island Bases Is Dangerously Wrong," *War on the Rocks*, January 10, 2020; Kerry K. Gershaneck and James E. Fanell, "This Is How China's [Military] Will Fight And Win A War In The South China Sea," *National Interest*, January 18, 2020.

[67] See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke, and CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

[68] For additional discussion, see Alex Lockie, "US Navy Admits Failure on $760 Million Weapon to Protect Its Aircraft Carriers from An Age-Old Threat," *Business Insider*, February 5, 2019; Joseph Trevithick, "The Navy Is Ripping Out Underperforming Anti-Torpedo Torpedoes From Its Supercarriers," *The Drive*, February 5, 2019.

[69] See, for example, James Turnwall, "The Navy Is Losing the Missile Arms Race," *U.S. Naval Institute Proceedings*, November 2019. For a similar discussion regarding U.S. and Chinese air-to-air missiles, see Douglas Barrie, "Will America's Next Long-Range Ait-to-Air Missile Match Up to China's?" *Defense One*, October 22, 2019.

> strike weapons capabilities (e.g. Maritime Strike Tomahawk (MST), LRASM V1.1, SM-6/Block 1B, and the Naval Strike Missile). Third, the Department will develop next-generation strike missile capabilities to address emerging threats.
>
> The OMS is reviewed annually based on current capabilities and emerging threats, and updated to leverage analytical processes/study updates. The results are used to inform annual RDT&E and procurement funding priorities to achieve an optimal mix of offensive strike missile system capabilities. The 2020 OMS is currently being finalized and is a classified document. Additional details about next generation weapons development can be provided in a classified setting.[70]

The issue of the operating range of Navy carrier air wings is a key component of an ongoing debate over the future survivability, utility, and cost-effectiveness of aircraft carriers and their air wings, with critics arguing that the current operating range of Navy carrier air wings will force Navy aircraft carriers to operate well within the ranges of Chinese ASBMs or other A2/AD systems, which could put the carriers' survivability at substantial risk, or alternatively require carriers to operate beyond the range of those Chinese A2/AD systems, in locations that are safer but so far away that the carriers and their air wings will contribute little combat capability.

A key U.S. Navy program for increasing the operating range of Navy carrier air wings is the MQ-25 Stingray program, which is a program to acquire a carrier-based unmanned aerial vehicle (UAV) for use as a tanker for in-flight refueling of manned carrier-based aircraft (with a secondary mission of intelligence, surveillance, and reconnaissance). Some observers, while not necessarily objecting to the MQ-25 program, argue that the Navy should do more to increase the operating range of Navy carrier air wings, such as developing a stealthy, carrier-based UAV capable of penetrating enemy air defenses and striking land targets at very long ranges.

The issue of acquisition policies and the metrics for judging their success is discussed in more detail in another CRS report.[71]

Legislative Activity for FY2021

The Navy's proposed FY2021 budget was submitted on February 10, 2020.

Coverage in Related CRS Reports

A variety of CRS reports cover U.S. Navy programs that in varying degrees can be viewed as responses to, among other things, China's naval modernization effort. These reports include but are not limited to the following:

- CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke

[70] Statement of the Honorable James F. Geurts, Assistant Secretary of the Navy, Research, Development and Acquisition ASN(RD&A), and 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, before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on the Department of the Navy Fiscal Year 2021 Budget Rrequest for Seapower and Projection Forces, March 4, 2020, p. 20.

[71] See CRS Report R43838, *Renewed Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

- CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by Jeremiah Gertler (the JSF program is a joint DOD program with Navy participation)
- CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R44972, *Navy Frigate (FFG[X]) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R44175, *Navy Lasers, Railgun, and Gun-Launched Guided Projectile: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke

Appendix A. Comparing U.S. and Chinese Naval Capabilities

This appendix presents some additional discussion of factors involved in comparing U.S. and Chinese naval capabilities.

U.S. and Chinese naval capabilities are sometimes compared by showing comparative numbers of U.S. and Chinese ships. Although the total number of ships in a navy (or its aggregate tonnage) is relatively easy to calculate, it is a one-dimensional measure that leaves out numerous other factors that bear on a navy's capabilities and how those capabilities compare to its assigned missions. One-dimensional comparisons of the total numbers of ships in China's navy and the U.S. Navy are highly problematic as a means of assessing relative U.S. and Chinese naval capabilities and how those capabilities compare to the missions assigned to those navies, for the following reasons:

- **A fleet's total number of ships (or its aggregate tonnage) is only a partial metric of its capability.** Many factors other than ship numbers (or aggregate tonnage) contribute to naval capability, including types of ships, types and numbers of aircraft, the sophistication of sensors, weapons, C4ISR systems, and networking capabilities, supporting maintenance and logistics capabilities, doctrine and tactics, the quality, education, and training of personnel, and the realism and complexity of exercises. In light of this, navies with similar numbers of ships or similar aggregate tonnages can have significantly different capabilities, and navy-to-navy comparisons of numbers of ships or aggregate tonnages can provide a highly inaccurate sense of their relative capabilities. In recent years, the warfighting capabilities of navies have derived increasingly from the sophistication of their internal electronics and software. This factor can vary greatly from one navy to the next, and often cannot be easily assessed by outside observation. As the importance of internal electronics and software has grown, the idea of comparing the warfighting capabilities of navies principally on the basis of easily observed factors such as ship numbers and tonnages has become increasingly less reliable, and today is highly problematic.
- **Total numbers of ships of a given type (such as submarines or surface combatants) can obscure potentially significant differences in the capabilities of those ships, both between navies and within one country's navy.** Differences in capabilities of ships of a given type can arise from a number of other factors, including sensors, weapons, C4ISR systems, networking capabilities, stealth features, damage-control features, cruising range, maximum speed, and reliability and maintainability (which can affect the amount of time the ship is available for operation).
- **A focus on total ship numbers reinforces the notion that changes in total numbers necessarily translate into corresponding or proportional changes in aggregate capability.** For a Navy like China's, which is modernizing by replacing older, obsolescent ships with more modern and more capable ships, this is not necessarily the case. As shown in **Table 1** and **Table 2**, for example, China's attack submarine force today has only a slightly larger number of boats than it had in 2000 or 2005, but it has considerably more aggregate capability than it did in 2000 or 2005, because the force today includes a much larger percentage of relatively modern designs.

- **Comparisons of total numbers of ships (or aggregate tonnages) do not take into account the differing global responsibilities and homeporting locations of each fleet.** The U.S. Navy has substantial worldwide responsibilities, and a substantial fraction of the U.S. fleet is homeported in the Atlantic. As a consequence, only a certain portion of the U.S. Navy might be available for a crisis or conflict scenario in China's near-seas region, or could reach that area within a certain amount of time. In contrast, China's navy has more-limited responsibilities outside China's near-seas region, and its ships are all homeported along China's coast at locations that face directly onto China's near-seas region. In a U.S.-China conflict inside the first island chain, U.S. naval and other forces would be operating at the end of generally long supply lines, while Chinese naval and other forces would be operating at the end of generally short supply lines.
- **Comparisons of numbers of ships (or aggregate tonnages) do not take into account maritime-relevant military capabilities that countries might have outside their navies,** such as land-based anti-ship ballistic missiles (ASBMs), land-based anti-ship cruise missiles (ASCMs), and land-based Air Force aircraft armed with ASCMs or other weapons. Given the significant maritime-relevant non-navy forces present in both the U.S. and Chinese militaries, this is a particularly important consideration in comparing U.S. and Chinese military capabilities for influencing events in the Western Pacific. Although a U.S.-China incident at sea might involve only navy units on both sides, a broader U.S.-China military conflict would more likely be a force-on-force engagement involving multiple branches of each country's military.
- **The missions to be performed by one country's navy can differ greatly from the missions to be performed by another country's navy.** Consequently, navies are better measured against their respective missions than against one another. Although Navy A might have less capability than Navy B, Navy A might nevertheless be better able to perform Navy A's intended missions than Navy B is to perform Navy B's intended missions. This is another significant consideration in assessing U.S. and Chinese naval capabilities, because the missions of the two navies are quite different.

A 2015 RAND report attempts to take factors like those discussed above more fully into account with the aim of producing a more comprehensive assessment of relative U.S. and Chinese military capabilities for potential conflict scenarios involving Taiwan and the Spratly Islands in the South China Sea. The report states the following:

> Over the past two decades, China's People's Liberation Army (PLA) has transformed itself from a large but antiquated force into a capable, modern military. In most areas, its technology and skill levels lag behind those of the United States, but it has narrowed the gap. Moreover, it enjoys the advantage of proximity in most plausible scenarios and has developed capabilities that capitalize on that advantage....
>
> ... four broad trends emerge:
>
> • Since 1996, the PLA has made tremendous strides, and, despite improvements to the U.S. military, the net change in capabilities is moving in favor of China. Some aspects of Chinese military modernization, such as improvements to PLA ballistic missiles, fighter aircraft, and attack submarines, have come extraordinarily quickly by any reasonable historical standard.
>
> • The trends vary by mission area, and relative Chinese gains have not been uniform across all areas. In some areas, U.S. improvements have given the United States new options, or

> at least mitigated the speed at which Chinese military modernization has shifted the relative balance.
>
> • Distances, even relatively short distances, have a major impact on the two sides' ability to achieve critical objectives. Chinese power projection capabilities are improving, but present limitations mean that the PLA's ability to influence events and win battles diminishes rapidly beyond the unrefueled range of jet fighters and diesel submarines. This is likely to change in the years beyond those considered in this report, though operating at greater distances from China will always work, on balance, against China.
>
> • The PLA is not close to catching up to the U.S. military in terms of aggregate capabilities, but it does not need to catch up to the United States to dominate its immediate periphery. The advantages conferred by proximity severely complicate U.S. military tasks while providing major advantages to the PLA. This is the central finding of this study and highlights the value of campaign analysis, rather than more abstract assessments of capabilities.
>
> Over the next five to 15 years, if U.S. and PLA forces remain on roughly current trajectories, Asia will witness a progressively receding frontier of U.S. dominance. The United States would probably still prevail in a protracted war centered in virtually any area, and Beijing should not infer from the above generalization that it stands to gain from conflict. U.S. and Chinese forces would likely face losses on a scale that neither has suffered in recent decades. But PLA forces will become more capable of establishing temporary local air and naval superiority at the outset of a conflict. In certain regional contingencies, this temporal or local superiority might enable the PLA to achieve limited objectives without "defeating" U.S. forces. Perhaps even more worrisome from a military-political perspective, the ability to contest dominance might lead Chinese leaders to believe that they could deter U.S. intervention in a conflict between it and one or more of its neighbors. This, in turn, would undermine U.S. deterrence and could, in a crisis, tip the balance of debate in Beijing as to the advisability of using force....
>
> Although trends in the military balance are running against the United States, there are many actions that the United States could take to reinforce deterrence and continue to serve as the ultimate force for stability in the Western Pacific.[72]

As mentioned earlier, while comparisons of the total numbers of ships in the PLAN and the U.S. Navy are highly problematic as a means of assessing relative U.S. and Chinese naval capabilities and how those capabilities compare to the missions assigned to those navies, an examination of *the trends over time in the relative numbers of ships* can shed some light on how the relative balance of U.S. and Chinese naval capabilities might be changing over time.

[72] Eric Heginbotham, *The U.S.-China Military Scorecard, Forces, Geography, and the Evolving Balance of Power, 1996-2017*, Santa Monica (CA), RAND Corporation, 2015 (RAND report RR-392), pp. xix, xxx-xxxii.

Appendix B. U.S. Navy's Ability to Counter Chinese ASBMs

This appendix provides additional discussion of the issue of the U.S. Navy's ability to counter China's ASBMs.

Although China's projected ASBM, as a new type of weapon, might be considered a "game changer," that does not mean it cannot be countered. There are several potential approaches for countering an ASBM that can be imagined, and these approaches could be used in combination. The ASBM is not the first "game changer" that the Navy has confronted; the Navy in the past has developed counters for other new types of weapons, such as ASCMs, and is likely exploring various approaches for countering ASBMs.

Countering China's projected ASBMs could involve employing a combination of active (i.e., "hard-kill") measures, such as shooting down ASBMs with interceptor missiles, and passive (i.e., "soft-kill") measures, such as those for masking the exact location of Navy ships or confusing ASBM reentry vehicles. Employing a combination of active and passive measures would attack various points in the ASBM "kill chain"—the sequence of events that needs to be completed to carry out a successful ASBM attack. This sequence includes detection, identification, and localization of the target ship, transmission of that data to the ASBM launcher, firing the ASBM, and having the ASBM reentry vehicle find the target ship.

Attacking various points in an opponent's kill chain is an established method for countering an opponent's military capability. A September 30, 2011, press report, for example, quotes Lieutenant General Herbert Carlisle, the Air Force's deputy chief of staff for operations, plans, and requirements, as stating in regard to Air Force planning that "We've taken [China's] kill chains apart to the 'nth' degree."[73]

To attack the ASBM kill chain, Navy surface ships, for example, could operate in ways (such as controlling electromagnetic emissions or using deception emitters) that make it more difficult for China to detect, identify, and track those ships.[74] The Navy could acquire weapons and systems for disabling or jamming China's long-range maritime surveillance and targeting systems, for attacking ASBM launchers, for destroying ASBMs in various stages of flight, and for decoying and confusing ASBMs as they approach their intended targets. Options for destroying ASBMs in flight include the SM-3 midcourse BMD interceptor missile (including the new Block IIA

[73] David A. Fulghum, "USAF: Slash And Burn Defense Cuts Will Cost Missions, Capabilities," *Aerospace Daily & Defense Report,* September 30, 2011: 6.

[74] For a journal article discussing actions by the Navy during the period 1956-1972 to conceal the exact locations of Navy ships, see Robert G. Angevine, "Hiding in Plain Sight, The U.S. Navy and Dispersed Operations Under EMCON, 1956-1972," *Naval War College Review*, Spring 2011: 79-95. See also Jonathan F. Sullivan, Defending the Fleet From China's Anti-Ship Ballistic Missile: Naval Deception's Roles in Sea-Based Missile Defense, A Thesis submitted to the Faculty of the Graduate School of Arts and Sciences of Georgetown University in partial fulfillment of the requirements for the degree of Master of Arts in Security Studies, April 15, 2011, accessed August 10, 2011, at http://gradworks.umi.com/1491548.pdf; Jon Solomon, "Deception and the Backfire Bomber: Reexamining the Late Cold War Struggle Between Soviet Maritime Reconnaissance and U.S. Navy Countertargeting," *Information Dissemination* (*www.informationdissemination.net*), October 27, 2014; John Solomon, "Deception and the Backfire Bomber, Part II," *Information Dissemination* (*www.informationdissemination.net*), October 28, 2014; John Solomon, "Deception and the Backfire Bomber, Part III," *Information Dissemination* (*www.informationdissemination.net*), October 29, 2014; John Solomon, "Deception and the Backfire Bomber, Part IV," *Information Dissemination* (*www.informationdissemination.net*), October 30, 2014.

version), the SM-6 terminal-defense BMD interceptor missile,[75] and accelerating development and deployment of the hypervelocity projectile (HVP), electromagnetic rail gun (EMRG), and solid state lasers (SSLs).[76] Options for decoying and confusing ASBMs as they approach their intended targets include equipping ships with systems, such as electronic warfare systems or systems for generating radar-opaque smoke clouds or radar-opaque carbon-fiber clouds, that could confuse an ASBM's terminal-guidance radar.[77]

An October 4, 2016, press report states the following:

> Several times in the past, [Chief of Naval Operations John] Richardson has stressed that long range weapons developments from adversarial nations like Russia and China aren't the end-all, be-all of naval conflicts.
>
> Just because China's "carrier-killer" missile has a greater range than the planes aboard a US aircraft carrier doesn't mean the US would shy away from deploying a carrier within that range, Richardson has stated on different occasions.
>
> Again, Richardson challenged the notion that a so-called A2/AD zone was "an impenetrable keep out zone that forces can only enter at extreme peril to their existence, let alone their mission."
>
> Richardson took particular issue with the "denial" aspect of A2/AD, repeating his assertion that this denial is an "aspiration" not a "fait accompli." The maps so common in representing these threats often mark off the limits of different system's ranges with "red arcs that extend off coastlines," with the implication that military forces crossing these lines face "certain destruction."
>
> But this is all speculation according to Richardson: "The reality is far more complex, it's actually really hard to achieve a hit. It requires the completion of a really complex chain of events.... these arcs represent danger for sure... but the threats they are based on are not insurmountable, and can be managed, will be managed."
>
> "We can fight from within these defended areas, and we will... this is nothing new and has been done before," said Richardson.
>
> So while Russia and China can develop missiles and radars and declare their ranges on paper, things get a lot trickier in the real world, where the US has the most and best experience in operating.
>
> "Potential adversaries actually have different geographic features like choke points, islands, ocean currents, mountains," said Richardson, who urged against oversimplifying complicated, and always unique circumstances in so-called A2/AD zones.
>
> "Have no doubt, the US navy is prepared to go wherever it needs to go, at any time, and stay there for as long as necessary in response to our leadership's call to project our strategic influence," Richardson concluded.

[75] For more on the SM-3, including the Block IIA version, and the SM-6, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[76] For more on HVP, EMRG, and SSLs, see CRS Report R44175, *Navy Lasers, Railgun, and Gun-Launched Guided Projectile: Background and Issues for Congress*, by Ronald O'Rourke.

[77] Regarding the option of systems for generating radar-opaque smoke clouds, Thomas J. Culora, "The Strategic Implications of Obscurants," *Naval War College Review*, Summer 2010: 73-84; Scott Tait, "Make Smoke!" U.S. Naval Institute Proceedings, June 2011: 58-63. Regarding radar-opaque carbon-fiber clouds, see "7th Fleet Tests Innovative Missile Defense System," Navy News Services, June 26, 2014; Kevin McCaney, "Navy's Carbon-Fiber Clouds Could Make Incoming Missiles Miss Their Targets," *Defense Systems* (http://defensesystems.com), June 27, 2014. See also Sydney J. Freedberg Jr., "Cyber, EW Are Secret Missile Defense Weapons Too Secret To Use," *Breaking Defense*, December 4, 2015.

Similarly, an August 29, 2016, press report states the following:

> The United States Navy is absolutely confident in the ability of its aircraft carriers and carrier air wings to fly and fight within zones defended by so-called anti-access/area denial (A2/AD) weapons....
>
> In the view of the U.S. Navy leadership, A2/AD—as it is now called—has existed since the dawn of warfare when primitive man was fighting with rocks and spears. Overtime, A2/AD techniques have evolved as technology has improved with ever-greater range and lethality. Rocks and spears eventually gave way to bows and arrows, muskets and cannons. Thus, the advent of long-range anti-ship cruise and ballistic missiles is simply another technological evolution of A2/AD.
>
> "This is the next play in that," Adm. John Richardson, chief of naval operations, told The National Interest on Aug. 25 during an interview in his office in the Pentagon. "This A2/AD, well, it's certainly a goal for some of our competitors, but achieving that goal is much different and much more complicated."
>
> Indeed, as many U.S. Navy commanders including Richardson and Rear Adm. (Upper Half) DeWolfe Miller, the service's director of air warfare, have pointed out, anti-access bubbles defended by Chinese DF-21D or DF-26 anti-ship ballistic missile systems or Russian Bastion-P supersonic anti-ship missile systems are not impenetrable 'Iron Domes.' Nor do formidable Russian and Chinese air defense systems such as the S-400 or HQ-9 necessarily render the airspace they protect into no-go zones for the carrier air wing.
>
> Asked directly if he was confident in the ability of the aircraft carrier and its air wing to fight inside an A2/AD zone protected by anti-ship cruise and ballistic missiles as well as advanced air defenses, Richardson was unequivocal in his answer. "Yes," Richardson said—but he would not say how exactly how due to the need for operational security. "It's really a suite of capabilities, but I actually think we're talking too much in the open about some of the things we're doing, so I want to be thoughtful about how we talk about things so we don't give any of our competitors an advantage."...
>
> Miller said that there have been threats to the carrier since the dawn of naval aviation. In many ways, the threat to the carrier was arguably much greater during the Cold War when the Soviet Union massed entire regiments of Tupolev Tu-22M3 Backfires and deployed massive cruise missile-armed Oscar-class SSGN submarines to hunt down and destroy the Navy's flattops. The service developed ways to defeat the Soviet threat—and the carrier will adapt to fight in the current environment.
>
> "We could have had this interview twenty-years-ago and there would have been a threat," Miller said. "The nature of war and A2/AD is not new—that's my point. I don't want to downplay it, but our improvements in information warfare, electronic warfare, payloads, the weapons systems that we've previously talked about—plus our ability to train to those capabilities that we have—we will create sanctuaries, we'll fight in those sanctuaries and we're a maneuver force."[78]

An October 18, 2017, blog post states the following:

> Assuming the DF-21D is ready for battle, can America defend against China's mighty missile?

[78] Dave Majumdar, "Chief of Naval Operations Richardson: US Aircraft Carriers Can Fight Inside A2/AD Zones," *National Interest*, August 29, 2016. See also Ryan Pickrell, "Navy Admirals Brush Aside Biggest Worry Of Modern Naval Combat," *Daily Caller*, August 31, 2016; Dave Majumdar, "Here Is Why the US Military Is Not In Panic Mode Over China's Carrier-Killer Missiles," *National Interest*, June 20, 2016.

> While opinions are clearly mixed—in speaking to many sources over the last several years on this topic—it seems clear there is great nervousness in U.S. defense circles. However, as time has passed, initial fears have turned towards a more optimistic assessment....
>
> In the end, the weapon might not be the great "game-changer" that many point it out to be, but a great complicator.[79]

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Disclaimer

[79] Harry J. Kazianis, "Could China's Aircraft Carrier Killer Missiles 'Sink' the U.S. Navy?" *National Interest*, October 18, 2017. See also Dick Mosier, "Breaking the Anti-Ship Missile Kill Chain," Center for International Maritime Security, February 26, 2018; Richard A. Bitzinger, "The Myth of the 'Game-Changer' Weapon," Asia Times, April 26, 2018.