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

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Summary

The question of how the United States should respond to China's military modernization effort, including its naval modernization effort, is a key issue in U.S. defense planning and budgeting.

China has been steadily building a modern and powerful navy since the early to mid-1990s. China's navy 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.

Observers view China's improving naval capabilities as posing a challenge in the Western Pacific to the U.S. Navy's ability to achieve and maintain control of blue-water ocean areas in wartime—the first such challenge the U.S. Navy has faced since the end of the Cold War. More broadly, these observers view China's naval capabilities as a key element of a broader Chinese military 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.

Observers believe China's naval modernization effort is oriented toward developing capabilities for doing the following: addressing the situation with Taiwan militarily, if need be; asserting and defending China's territorial claims in the South China Sea and East China Sea, and more generally, achieving a greater degree of control or domination over the SCS; enforcing China's view that it has the right to regulate foreign military activities in its 200-mile maritime exclusive economic zone (EEZ); defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf; displacing U.S. influence in the Western Pacific; and asserting China's status as a leading regional power and major world power.

Consistent with these goals, observers believe China wants its military to be capable of acting as an 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.

Potential oversight issues for Congress include the following:

- whether the U.S. Navy in coming years will be large enough and capable enough to adequately counter improved Chinese maritime A2/AD forces while also adequately performing other missions around the world;
- whether the Navy's plans for developing and procuring long-range carrier-based aircraft and long-range ship- and aircraft-launched weapons are appropriate and adequate;
- whether the Navy can effectively counter Chinese ASBMs and submarines; and
- whether the Navy, in response to China's maritime A2/AD capabilities, should shift over time to a more distributed fleet architecture.

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Introduction

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. The question of how the United States should respond to China's military modernization effort, including its naval modernization effort, is a key issue in U.S. defense planning and budgeting. Many U.S. military programs for countering improving Chinese military forces (particularly its naval forces) fall within the U.S. Navy's budget.

The issue for Congress is how the U.S. Navy should respond to China's military modernization effort, particularly its naval modernization effort. Decisions that Congress reaches on this issue could affect U.S. Navy capabilities and funding requirements and the U.S. defense industrial base.

For an overview of the strategic and budgetary context in which China's naval modernization effort and its implications for U.S. Navy capabilities may be considered, see **Appendix A**.

Scope, Sources, and Terminology

This report focuses 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 (name redacted) and David Gitter

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,¹ 2015 and 2009 reports on China's navy from the Office of Naval Intelligence (ONI),² published reference sources such as *IHS Jane's Fighting Ships*, 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.

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*

¹ Department of Defense, *Annual Report to Congress [on] Military and Security Developments Involving the People's Republic of China 2017*, May 15, 2017. Hereinafter *2017 DOD CMSD*. The 2010-2016 editions of the report are cited similarly. The 2009 and earlier editions of the report were known as the China military power report; the 2009 edition is cited as *2009 DOD CMP*, and earlier editions are cited similarly.

² Office of Naval Intelligence, *The PLA Navy, New Capabilities and Missions for the 21st Century*, undated but released in April 2015, 47 pp., and *The People's Liberation Army Navy, A Modern Navy with Chinese Characteristics*, August 2009, 46 pp. Hereinafter *2015 ONI Report* and *2009 ONI Report*, respectively.

island chain encloses both these waters and the Philippine Sea that is situated between the Philippines and Guam.³

Background

Overview of China's Naval Modernization Effort⁴

Underway for More Than 25 Years

China's naval modernization effort has been underway for more than 25 years: Design work on the first of China's newer ship classes, for example, appears to have begun in the late-1980s.⁵ Some observers believe that China's military (including naval) modernization effort may have been reinforced or accelerated by China's observation of U.S. military operations against Iraq in Operation Desert Storm in 1991,⁶ and by a 1996 incident in which the United States deployed two aircraft carrier strike groups to waters near Taiwan in response to Chinese missile tests and naval exercises near Taiwan.⁷ One observer states that "since the end of [China's] ninth Five-Year Plan in 2000, China has embarked on an ambitious naval construction program. The goal was to dramatically increase the ability of the PLA Navy and the Chinese Coast Guard (CCG) to stage "blue-water" operations within the first and second island chains (including the Philippines and Indonesia) while enabling 'far-seas' deployments around much of the globe."⁸

A Broad-Based Modernization Effort

Although press reports on China's naval modernization effort sometimes focus on a single element, such as China's aircraft carrier program or its anti-ship ballistic missiles (ASBMs), China's naval modernization effort is a broad-based effort with many elements. China's naval modernization effort includes a wide array of platform and weapon acquisition programs, including programs for ASBMs, anti-ship cruise missiles (ASCMs), land-attack cruise missiles (LACMs), surface-to-air missiles, mines, manned aircraft, submarines, aircraft carriers, destroyers, frigates, corvettes, patrol craft, amphibious ships, mine countermeasures (MCM) ships, underway replenishment ships, hospital ships, unmanned vehicles (UVs), and supporting C4ISR⁹ systems. Some of these acquisition programs are discussed in further detail below.

³ For a map showing the first and second island chains, see *2015 DOD CMSD*, p. 87.

⁴ Unless otherwise indicated, shipbuilding program information in this section is taken from *IHS Jane's Fighting Ships 2017-2018*, 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.

⁵ China laid the keel on its first Song (Type 039) class submarine in 1991, its first Luhui (Type 052) class destroyer in 1990, and its first Jiangwei I (Type 053 H2G) class frigate in 1990. First-in-class ships whose keels were laid down in 1990 or 1991 likely reflect design work done in the latter 1980s.

⁶ See, for example, Robert Farley, "What Scares China's Military: The 1991 Gulf War," *National Interest*, November 24, 2014.

⁷ DOD, for example, stated in 2011 that "The U.S. response in the 1995-96 Taiwan Strait crisis underscored to Beijing the potential challenge of U.S. military intervention and highlighted the importance of developing a modern navy, capable of conducting A2AD [anti-access/area-denial] operations, or 'counter-intervention operations' in the PLA's lexicon." (*2011 DOD CMSD*, p. 57.)

⁸ James E. Fanell, "In Naval Deterrence, Numbers Matter," Geopolitical Intelligence Services, October 30, 2017.

⁹ C4ISR stands for command and control, communications, computers, intelligence, surveillance, and reconnaissance.

China's naval modernization effort also includes improvements in maintenance and logistics, doctrine, personnel quality, education and training, and exercises.

Quality vs. Quantity

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. Changes in platform capability and the percentage of the force accounted for by modern platforms had generally been more dramatic than changes in total platform numbers. In some cases (such as submarines and coastal patrol craft), total numbers of platforms actually decreased over the past 20 years or so, but aggregate capability nevertheless increased because a larger number of older and obsolescent platforms have been replaced by a smaller number of much more modern and capable new platforms. ONI stated in 2015 that "China's force modernization has concentrated on improving the quality of its force, rather than its size. Quantities of major combatants have stayed relatively constant, but their combat capability has greatly increased as older combatants are replaced by larger, multi-mission ships."¹⁰

Some categories of ships, however, are now increasing in number; examples include (but are not necessarily limited to) the following:

- **Ballistic missile submarines.** Through 2008, China had only one ballistic missile submarine. By 2016, that figure had grown to four.
- **Aircraft carriers.** Until 2012, China had no aircraft carriers. China's first carrier entered service in 2012. China is building two additional carriers, and observers speculate China may eventually field a total force of four to six carriers.
- **Corvettes (i.e., light frigates).** Until 2014, China had no corvettes. Since then, China has built corvettes at a rapid rate, and 37 had reportedly entered service as of November 2017, with some observers projecting an eventual force of 60.

In addition, as shown in the 2017 column of **Table 6**, total numbers of destroyers and LST/LPD-type amphibious ships may now be increasing above the levels at which they had been over the last decade or so.

China is also building large numbers of cutters for its coast guard, and total numbers of larger cutters have grown substantially in recent years.

Whether they are to replace older ships or increase total numbers of ships, new ships are entering service with China's navy at a relatively high rate. A February 22, 2017, press report states the following:

In 2016, the PLA Navy commissioned 18 ships, including a Type 052D guided missile destroyer, three Type 054A guided missile frigates as well as six Type 056 corvettes.

These [18] ships have a total displacement of 150,000 tons, roughly half of the overall displacement of the [British] Royal Navy.

In January alone, the Navy commissioned three ships—one destroyer, one electronic reconnaissance ship and one corvette.¹¹

China in late-2016 or early-2017 may have decided to increase its role on the world stage beyond previously planned levels, perhaps in part in reaction to a perception, correct or not, that the

¹⁰ 2015 ONI Report, p. 5. See also p. 13.

¹¹ Zhang Tao, "Navy Upgrades Missile Destroyer," *China Military*, February 22, 2017.

United States is reducing its role on the world stage.¹² Such a decision by China could affect its naval modernization effort: pursuing a larger role on the world stage than previously planned could lead China to shift to a naval modernization effort that, while maintaining a focus on improving quality, also focuses more than previously planned on increasing total numbers of platforms. Put differently, while China until recently may have been aiming at developing a regionally powerful Navy with an added capability for conducting occasional, limited, or tightly focused naval operations in more distant waters, it might now pursue a more ambitious goal of developing a navy with more extensive capabilities for global operations.

Limitations and Weaknesses

Although China's naval modernization effort has substantially improved China's naval capabilities in recent years, observers believe China's navy currently has limitations or weaknesses in certain areas, including joint operations with other parts of China's military,¹³ antisubmarine warfare (ASW),¹⁴ a dependence on foreign suppliers for some ship components,¹⁵ and long-range targeting.¹⁶ China is working to overcome such limitations and weaknesses.¹⁷ ONI states that "Although the PLA(N) faces some capability gaps in key areas, it is emerging as a well equipped and competent force."¹⁸

The sufficiency of a country's naval capabilities is best assessed against that navy's intended missions. 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

¹² For additional discussion, see CRS Report R44891, *U.S. Role in the World: Background and Issues for Congress*, by (name redacted) and (name redacted) .

¹³ See, for example, 2015 ONI Report, p. 31. See also Minnie Chan, "PLA Navy in Future Will Have World-Class Ships, But Not The Expertise to Operate Them, Military Observers Say," *South China Morning Post*, July 27, 2015.

¹⁴ DOD states that "The PLA is making gradual progress in the undersea domain as well, but continues to lack a robust deep-water ASW capability." (2017 DOD CMSD, p. 50.)

¹⁵ Regarding China's naval/shipbuilding industry, DOD states that "China continues to invest in foreign suppliers for some propulsion units, but is becoming increasingly self-sufficient." (2017 DOD CMSD, p. 69.) See also Andrew S. Erickson, "Steaming Ahead, Course Uncertain: China's Military Shipbuilding Industry," *National Interest*, May 19, 2016; Andrew S. Erickson, "China's Naval Shipbuilding Sets Sail," *National Interest*, February 8, 2017; For a discussion of China's weaknesses and limitations in general, see Andrew Erickson, "How Good Are They? The Latest Insights into China's Military Tech," *War on the Rocks*, May 18, 2016; Andrew S. Erickson, "Clear Strengths, Fuzzy Weaknesses In China's Massive Military Buildup," *China Real Time (Wall Street Journal)*, May 9, 2015.

¹⁶ DOD states that "It is unclear whether the PLA can collect accurate targeting information and pass it to launch platforms in time for successful strikes in sea areas beyond the first island chain." (2017 DOD CMSD, p. 50.) See also Richard A. Bitzinger, "China's Not-So-Wonderful Weapons," *Asia Times*, February 23, 2016.

¹⁷ DOD states, for example, that "In 2016, the PLA continued to focus training to execute large-scale, complex joint operations. This included greater realism during exercises, strengthened strategic campaign training, and the execution of long-distance maneuvers and mobility operations." (2017 DOD CMSD, p. 3.) See, also, for example, Anthony Kuhn, "China Is Placing Underwater Sensors In The Pacific Near Guam," *NPR*, February 6, 2018; Joseph Trevithick, "China Reveals It Has Two Underwater Listening Devices Within Range of Guam," *The Drive*, January 23, 2018; Stephen Chen, "Surveillance Under the Sea: How China Is Listening Near Guam," *South China Morning Post*, January 22, 2018; Steven Stashwick, "New Chinese Ocean Network Collecting Data to Target Submarines," *The Diplomat*, January 2, 2018; Stephen Chen, "China's Underwater Surveillance Network Puts Targets in Focus Along Maritime Silk Road," *South China Morning Post*, December 31, 2017, updated January 1, 2018; Joseph Trevithick, "South China Sea Underwater 'Environmental' Sensor Net Could Track U.S. Subs," *The Drive*, May 30, 2017; Prashanth Parameswaran, "Where Is China's New Underwater System in the East and South China Seas?" *The Diplomat*, May 30, 2017; Joel Wuthnow and Phillip C. Saunders, "From Green to Purple: Can the Chinese Military Become More Joint?" *War on the Rocks*, March 30, 2017.

¹⁸ 2015 ONI Report, p. 13.

weaknesses and limitations, it may become sufficient to perform a wider array of potential missions.

Roles and Missions for China's Navy

Observers believe China's naval modernization effort is oriented toward developing capabilities for doing the following:

- addressing the situation with Taiwan militarily, if need be;
- asserting and defending China's territorial claims in the South China Sea (SCS) and East China Sea (ECS), and more generally, achieving a greater degree of control or domination over the SCS;¹⁹
- enforcing China's view—a minority view among world nations—that it has the legal right to regulate foreign military activities in its 200-mile maritime exclusive economic zone (EEZ);²⁰
- defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf;
- displacing U.S. influence in the Western Pacific; and
- asserting China's status as a leading regional power and major world power.²¹

Most observers believe that, consistent with these goals, China wants its military to be capable of acting as an 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.²² (A2/AD is a term used by U.S. and other Western writers. During the Cold War, U.S. writers used the term sea-denial force to refer to a maritime A2/AD force.) ASBMs, ASCMs, attack submarines, and supporting C4ISR systems are viewed as key elements of China's emerging maritime A2/AD force, though other force elements are also of significance in that regard.

China's maritime A2/AD force can be viewed as broadly analogous to the sea-denial force that the Soviet Union developed during the Cold War with the aim of denying U.S. use of the sea and countering U.S. naval forces participating in a NATO-Warsaw Pact conflict. One difference between the Soviet sea-denial force and China's emerging maritime A2/AD force is that China's force includes conventionally armed ASBMs capable of hitting moving ships at sea.

Additional missions for China's navy include conducting maritime security (including antipiracy) operations, evacuating Chinese nationals in foreign countries when necessary, and conducting humanitarian assistance/disaster response (HA/DR) operations.

DOD states that

¹⁹ For more on China's territorial claims in the SCS and ECS, see CRS Report R42784, *Maritime Territorial and Exclusive Economic Zone (EEZ) Disputes Involving China: Issues for Congress*, by (name redacted), and CRS Report R42930, *Maritime Territorial Disputes in East Asia: Issues for Congress*, by (name redacted), (name redacted), and (name redacted). See also CRS Report R44072, *Chinese Land Reclamation in the South China Sea: Implications and Policy Options*, by (name redacted) et al.

²⁰ For more on China's view regarding its rights within its EEZ, see CRS Report R42784, *Maritime Territorial and Exclusive Economic Zone (EEZ) Disputes Involving China: Issues for Congress*, by (name redacted).

²¹ For a discussion of roles and missions of China's navy, see *2015 ONI Report*, pp. 8-11.

²² See, for example, *2017 DOD CMSD*, pp. 49-52.

As China's global footprint and international interests have grown, its military modernization program has become more focused on supporting missions beyond China's periphery, including power projection, sea lane security, counterpiracy, peacekeeping, and humanitarian assistance/disaster relief (HA/DR).²³

DOD also states that

China's maritime emphasis and attention to missions guarding its overseas interests have increasingly propelled the PLA beyond China's borders and its immediate periphery. The PLAN's evolving focus—from "offshore waters defense" to a mix of "offshore waters defense" and "far seas protection"—reflects the high command's expanding interest in a wider operational reach. Similarly, doctrinal references to "forward edge defense" that would move potential conflicts far from China's territory suggest PLA strategists envision an increasingly global role.²⁴

DOD also states that

The PLAN continues to develop into a global force, gradually extending its operational reach beyond East Asia and into what China calls the "far seas." The PLAN's latest naval platforms enable combat operations beyond the reaches of China's land-based defenses. In particular, China's aircraft carrier and planned follow-on carriers, once operational, will extend air defense umbrellas beyond the range of coastal systems and help enable task group operations in "far seas." The PLAN's emerging requirement for sea-based land-attack will also enhance China's ability to project power. More generally, the expansion of naval operations beyond China's immediate region will also facilitate non-war uses of military force.²⁵

DOD states that China's 2015 defense white paper, labeled a "military strategy" and released in May 2015, "elevated the maritime domain within the PLA's formal strategic guidance and shifted the focus of its modernization from 'winning local wars under conditions of informationization' to 'winning informationized local wars, highlighting maritime military struggle.'²⁶ The white paper states that

With the growth of China's national interests, its national security is more vulnerable to international and regional turmoil, terrorism, piracy, serious natural disasters and epidemics, and the security of overseas interests concerning energy and resources, strategic sea lines of communication (SLOCs), as well as institutions, personnel and assets abroad, has become an imminent issue....

To implement the military strategic guideline of active defense in the new situation, China's armed forces will adjust the basic point for PMS [preparation for military struggle]. In line with the evolving form of war and national security situation, the basic point for PMS will be placed on winning informationized local wars, highlighting maritime military struggle and maritime PMS....

In line with the strategic requirement of offshore waters defense and open seas protection, the PLA Navy (PLAN) will gradually shift its focus from "offshore waters defense" to the combination of "offshore waters defense" with "open seas protection," and build a combined, multi-functional and efficient marine combat force structure. The PLAN will enhance its capabilities for strategic deterrence and counterattack, maritime maneuvers, joint operations at sea, comprehensive defense and comprehensive support....

²³ 2017 DOD CMSD, p. ii. See also *ONI Report*, pp. 8-11.

²⁴ 2017 DOD CMSD, p. 40.

²⁵ 2017 DOD CMSD, p. 52.

²⁶ 2016 DOD CMSD, p. 4.

The seas and oceans bear on the enduring peace, lasting stability and sustainable development of China. The traditional mentality that land outweighs sea must be abandoned, and great importance has to be attached to managing the seas and oceans and protecting maritime rights and interests. It is necessary for China to develop a modern maritime military force structure commensurate with its national security and development interests, safeguard its national sovereignty and maritime rights and interests, protect the security of strategic SLOCs and overseas interests, and participate in international maritime cooperation, so as to provide strategic support for building itself into a maritime power.²⁷

2014 ONI Testimony

In his prepared statement for a January 30, 2014, hearing on China's military modernization and its implications for the United States before the U.S.-China Economic and Security Review Commission, Jesse L. Karotkin, ONI's Senior Intelligence Officer for China, summarized China's naval modernization effort. For the text of Karotkin's statement, see **Appendix B**.

Selected Elements of China's Naval Modernization Effort

Anti-Ship Ballistic Missiles (ASBMs) and Anti-Ship Cruise Missiles (ASCMs)

Anti-Ship Ballistic Missiles (ASBMs)

China is fielding an ASBM, referred to as the DF-21D, that is a theater-range ballistic missile equipped with a maneuverable reentry vehicle (MaRV) designed to moving hit ships at sea. A second type of Chinese theater-range ballistic missile, the DF-26, may also have an anti-ship capability. DOD states that

China's conventionally armed CSS-5 Mod 5 (DF-21D) anti-ship ballistic missile (ASBM) gives the PLA the capability to attack ships, including aircraft carriers, in the western Pacific Ocean.

In 2016, China began fielding the DF-26 intermediate-range ballistic missile (IRBM), which is capable of conducting conventional and nuclear precision strikes against ground targets and conventional strikes against naval targets in the western Pacific Ocean.²⁸

Observers have expressed strong concern 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. Due to their ability to change course, the MaRVs on an ASBM would be more difficult to intercept than nonmaneuvering ballistic missile reentry vehicles.²⁹

²⁷ China's Military Strategy, The State Council Information Office of the People's Republic of China, May 2015, Beijing, released May 26, 2015, accessed July 27, 2015, at http://eng.mod.gov.cn/DefenseNews/2015-05/26/content_4586748.htm. "Informationized" is the English translation of a Chinese term that refers to modern warfare with precision-guided weapons and networks of platforms (i.e., ships, aircraft, etc.) that share targeting and other information.

²⁸ 2017 DOD CMSD, p. 31. See also 2009 ONI Report, pp. 26-27.

²⁹ For further discussion of China's ASBM and its potential implications for U.S. naval forces, see Andrew S. Erickson, (continued...)

DOD has been reporting on the DF-21D in its annual reports to Congress since 2008.³⁰ One observer states that “based on Chinese defense documents, what sets the [DF]-21D apart from the others is that it has a maneuverable re-entry vehicle with synthetic aperture radar (SAR) and optical sensors, which could enable it to hit a moving target.”³¹ According to press reports, the DF-21D has been tested over land but has not been tested in an end-to-end flight test against a target at sea. A January 23, 2013, press report about a test of the weapon in the Gobi desert in western China stated the following:

The People’s Liberation Army has successfully sunk a US aircraft carrier, according to a satellite photo provided by Google Earth, reports our sister paper *Want Daily*—though the strike was a war game, the carrier a mock-up platform and the “sinking” occurred on dry land in a remote part of western China.³²

A January 30, 2018, press report states the following:

Media reports suggest that a new variant of China’s mighty DF-21D missile has just gone through pre-deployment tests by a specialist brigade of the People’s Liberation Army’s Rocket Force, and that it has ramped-up assault capabilities that could put an aircraft-carrier strike group out of action.

State broadcaster China Central Television and Sina Military reported that the new missile was “30%” more powerful than the previous-generation DF-21D, but no details of its specifications or the parameters of the tests were provided.

It is believed that the series’ launch vehicle has received a big boost to its ability to travel off-road, as compared with the previous model that required support vehicles and would need to park on a huge solid-surface area prior to a launch.

It is not clear if the missile itself has been improved in terms of range or speed.³³

On September 3, 2015, at a Chinese military parade in Beijing that displayed numerous types of Chinese weapons, an announcer stated that the DF-26 may have an anti-ship capability.³⁴ The DF-26 has a reported range of 1,800 miles to 2,500 miles, or more than twice the reported range of the DF-21D.³⁵

(...continued)

“Raining Down: Assessing the Emergent ASBM Threat,” *Jane’s Navy International*, March 16, 2016.

³⁰ 2008 DOD CMP, pp. 2 and 23.

³¹ Otto Kreisher, “China’s Carrier Killer: Threat and Theatrics,” ETH Zurich, April 10, 2014, accessed September 18, 2017, at <https://www.ethz.ch/content/specialinterest/gess/cis/center-for-securities-studies/en/services/digital-library/articles/article.html/177869>.

³² “PLA ‘Sinks’ US Carrier in DF-21D Missile Test in Gobi,” *Want China Times* (<http://www.wantchinatimes.com>), January 23, 2013, accessed March 21, 2013, at <http://www.wantchinatimes.com/news-subclass-cnt.aspx?id=20130123000112&cid=1101>.

³³ Asia Times staff, “New Missile Variant ‘Could Keep US Carriers Out,’” *Asia Times*, January 30, 2018.

³⁴ See, for example, Richard D Fisher Jr., “DF-26 IRBM May Have ASM Variant, China Reveals at 3 September Parade,” *IHS Jane’s 360*, September 2, 2015; Wendell Minnick, “China’s Parade Puts US Navy on Notice,” *Defense News*, September 3, 2015; Andrew S. Erickson, “Showtime: China Reveals Two ‘Carrier-Killer’ Missiles,” *National Interest*, September 3, 2015. See also Fang Tian, “Donfeng[DF]-26 Can Strike Large Moving Targets Within 4,000 Kilometers: Expert,” *People’s Daily Online*, August 2, 2017.

³⁵ Thomas Gibbons-Neff, “China Showcases Advanced Ballistic Missiles at Military Parade,” *Washington Post*, September 3, 2015. Another press report states that the missile’s range is 3,000 km to 4,000 km, which equates to about 1,860 miles to about 2,480 miles, or to about 1,620 nautical miles to 2,160 nautical miles. (Richard D Fisher Jr., “DF-26 IRBM May Have ASM Variant, China Reveals at 3 September Parade,” *IHS Jane’s 360*, September 2, 2015.) See also Bill Gertz, “Access vs. Anti-Access: China, US Posture in Anti-Ship Missile Face Off,” *Asia Times*, December 14, 2015.

China reportedly is developing a hypersonic glide vehicle that, if incorporated into Chinese ASBMs, could make Chinese ASBMs more difficult to intercept.³⁶

Anti-Ship Cruise Missiles (ASCMs)

Among the most capable of the new ASCMs that have been acquired by China's navy are the Russian-made SS-N-22 Sunburn (carried by China's four Russian-made Sovremenny-class destroyers) and the Russian-made SS-N-27 Sizzler (carried by 8 of China's 12 Russian-made Kilo-class submarines). China's large inventory of ASCMs also includes several indigenous designs, including some highly capable models. DOD states that

China deploys a wide range of advanced ASCMs with the YJ-83 series as the most numerous, which are deployed on the majority of China's ships as well as multiple aircraft. China has also outfitted several ships with YJ-62 ASCMs and claims that the new LUYANG III class DDG and future Type 055 CG will be outfitted with a vertically launched variant of the YJ-18 ASCM. The YJ-18 is a long-range torpedo-tube-launched ASCM capable of supersonic terminal sprint which has likely replaced the older YJ-82 on SONG, YUAN, and SHANG class submarines. China has also developed the long range supersonic YJ-12 ASCM for the H-6 bomber. At China's military parade in September 2015, China displayed a ship-to-ship variant of the YJ-12 called the YJ-12A. China also carries the Russian SS-N-22 SUNBURN on four Russian built SOVREMENNY-class DDGs and the Russian SS-N-27b SIZZLER on eight Russian built KILO-class submarines.³⁷

DOD also states that

The PLAN continues to emphasize anti-surface warfare (ASUW). Older surface combatants carry variants of the YJ-83 ASCM (65 nm, 120 kilometers (km)), while newer surface combatants such as the LUYANG II DDG are fitted with the YJ-62 (150 nm, 222 km). The LUYANG III DDG and RENHAI CG will be fitted with a variant of China's newest ASCM, the YJ-18 (290 nm, 537 km). Eight of China's 12 KILO SS are equipped with the SS-N-27 ASCM (120 nm, 222 km), a system China acquired from Russia. China's newest indigenous submarine-launched ASCM, the YJ-18 and its variants, represents an improvement over the SS-N-27, and will be fielded on SONG SS, YUAN SSP, and SHANG SSN units.³⁸

³⁶ See, for example, Ankit Panda, "China's Hi-Tech Missile Ambitions Are Marching Ahead at Warp Speed," *South China Morning Post*, January 7, 2018; Kyle Mizokami, "China Reportedly Tests New DF-17 Hypersonic Weapon," *Popular Mechanics*, December 28, 2017; Stephen Chen, "China Builds World's Fastest Wind Tunnel to Test Weapons That Could Strike US Within 14 Minutes," *South China Morning Post*, November 15, 2017 (updated November 16, 2017); Joseph Trevithick, "China Shows Off Hypersonic Vehicle Test Model After US Navy Weapon Test," *The Drive*, November 7, 2017; Jeffrey Lin and P.W. Singer, "A Look at China's Most Exciting Hypersonic Aerospace Programs," *Popular Science*, April 18, 2017; Brian Wang, "China Reveals Hypersonic Scramjet Developments and Plans," *NextBigFuture*, April 14, 2017.

³⁷ 2017 DOD CMSD, p. 57.

³⁸ 2017 DOD CMSD, p. 25. See also Kyle Mizokami, "China Is Building a Sea-Skimming Anti-Ship Drone," *Popular Mechanics*, Mary 4, 2017; Zhao Lei, "'World's Best' Anti-Ship Missile A Showstopper," *China Daily*, *China Daily*, November 7, 2016; Alan Cummings, "A Thousand Splendid Guns, Chinese ASCMs in Competitive Control," *Naval War College Review*, Autumn 2016: 79-92.

Submarines, Mines, and Unmanned Underwater Vehicles (UUVs)

Submarines: Overview

China's submarine modernization effort has attracted substantial attention and concern. DOD states, "The PLAN places a high priority on the modernization of its submarine force."³⁹ ONI states that

China has long regarded its submarine force as a critical element of regional deterrence, particularly when conducting "counter-intervention" against modern adversary. The large, but poorly equipped [submarine] force of the 1980s has given way to a more modern submarine force, optimized primarily for regional anti-surface warfare missions near major sea lines of communication.⁴⁰

Submarine Types Acquired in Recent Years

China since the mid-1990s has acquired 12 Russian-made Kilo-class non-nuclear-powered attack submarines (SSs) and put into service at least four new classes of indigenously built submarines, including the following:

- a new nuclear-powered ballistic missile submarine (SSBN) design called the Jin class or Type 094 (**Figure 1**);
- a new nuclear-powered attack submarine (SSN) design called the Shang class or Type 093/093A;
- a new SS design called the Yuan class or Type 039A/B/C (**Figure 2**);⁴¹ and
- another (and also fairly new) SS design called the Song class or Type 039/039G.

Figure 1. Jin (Type 094) Class Ballistic Missile Submarine



Source: Photograph provided to CRS by Navy Office of Legislative Affairs, December 2010.

³⁹ 2017 DOD CMSD, p. 24.

⁴⁰ [Hearing on] Trends in China's Naval Modernization [before] U.S. China Economic and Security Review Commission[,], Testimony [of] Jesse L. Karotkin, [Senior Intelligence Officer for China, Office of Naval Intelligence, January 30, 2014], accessed February 12, 2014, p. 7. See also Lyle J. Goldstein, "Old-School Killers: Fear China's Sea Mines," *National Interest*, October 14, 2015.

⁴¹ Some sources refer to the Yuan class as the Type 041.

Figure 2. Yuan (Type 039A) Class Attack Submarine



Source: Photograph provided to CRS by Navy Office of Legislative Affairs, December 2010.

Submarine Capabilities and Armaments

The Kilos and the four new classes of indigenously built submarines are regarded as much more modern and capable than China's previous older-generation submarines. At least some of the new indigenously built designs are believed to have benefitted from Russian submarine technology and design know-how,⁴² and from knowledge from scientists who had worked at the Los Alamos National Laboratory in New Mexico and the Lawrence Livermore National Laboratory in California before moving back to China.⁴³

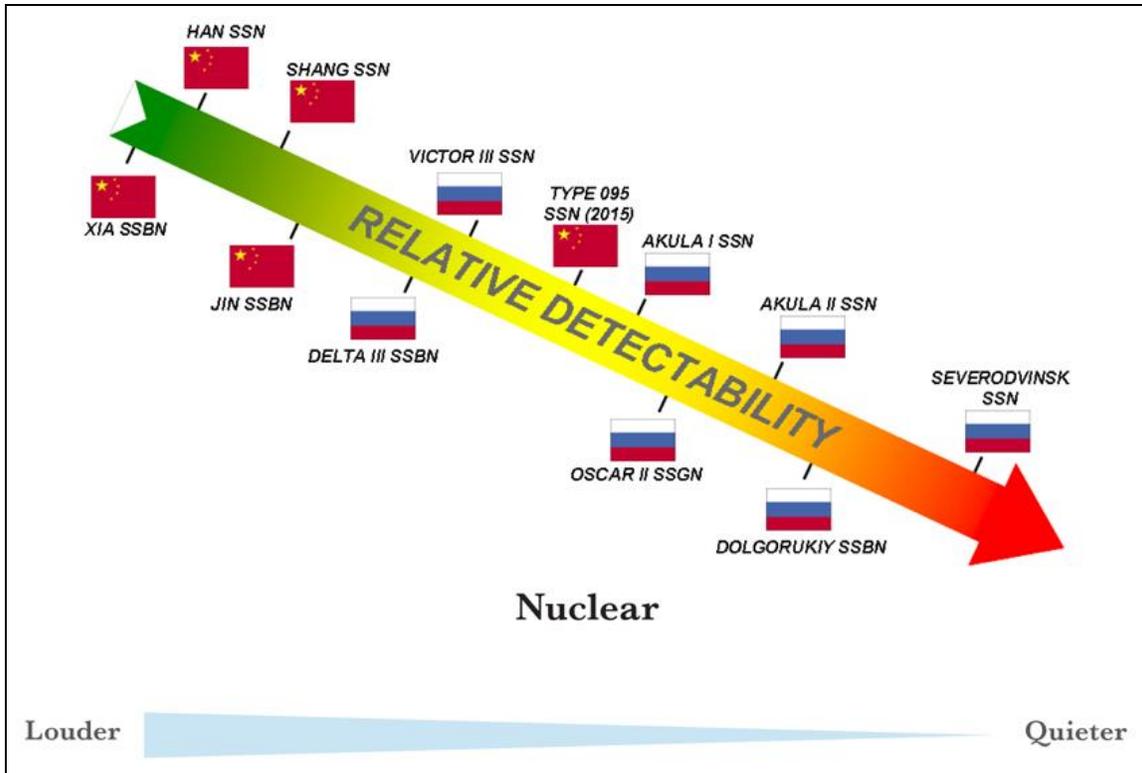
Figure 3 and **Figure 4**, which are taken from the August 2009 ONI report, show the acoustic quietness of Chinese nuclear- and non-nuclear-powered submarines, respectively, relative to that of Russian nuclear- and non-nuclear-powered submarines. In **Figure 3** and **Figure 4**, the downward slope of the arrow indicates the increasingly lower noise levels (i.e., increasing acoustic quietness) of the submarine designs shown. In general, quieter submarines are more difficult for opposing forces to detect and counter. The green-yellow-red color spectrum on the arrow in each figure might be interpreted as a rough indication of the relative difficulty that a navy with capable antisubmarine warfare forces (such as the U.S. Navy) might have in detecting and countering these submarines: Green might indicate submarines that would be relatively easy for such a navy to detect and counter, yellow might indicate submarines that would be less easy

⁴² The August 2009 ONI report, for example, states that the Yuan class may incorporate quieting technology from the Kilo class (2009 ONI Report, p. 23).

⁴³ Stephen Chen, "America's Hidden Role in Chinese Weapons Research," *South China Morning Post*, March 29, 2017.

for such a navy to detect and counter, and red might indicate submarines that would be more difficult for such a navy to detect and counter.⁴⁴

Figure 3. Acoustic Quietness of Chinese and Russian Nuclear-Powered Submarines



Source: 2009 ONI Report, p. 22.

China’s submarines are armed with one or more of the following: ASCMs, wire-guided and wake-homing torpedoes, and mines.⁴⁵ Eight of the 12 Kilos purchased from Russia (presumably the ones purchased more recently) are armed with the highly capable Russian-made SS-N-27 Sizzler ASCM. In addition to other weapons, Shang-class SSNs may carry LACMs. Although ASCMs are often highlighted as sources of concern, wake-homing torpedoes are also a concern because they can be very difficult for surface ships to counter.

China has announced that it is developing electric-drive propulsion systems using permanent magnet motors, as well as electrically powered, rim-driven propellers that could help make future Chinese submarines quieter.⁴⁶

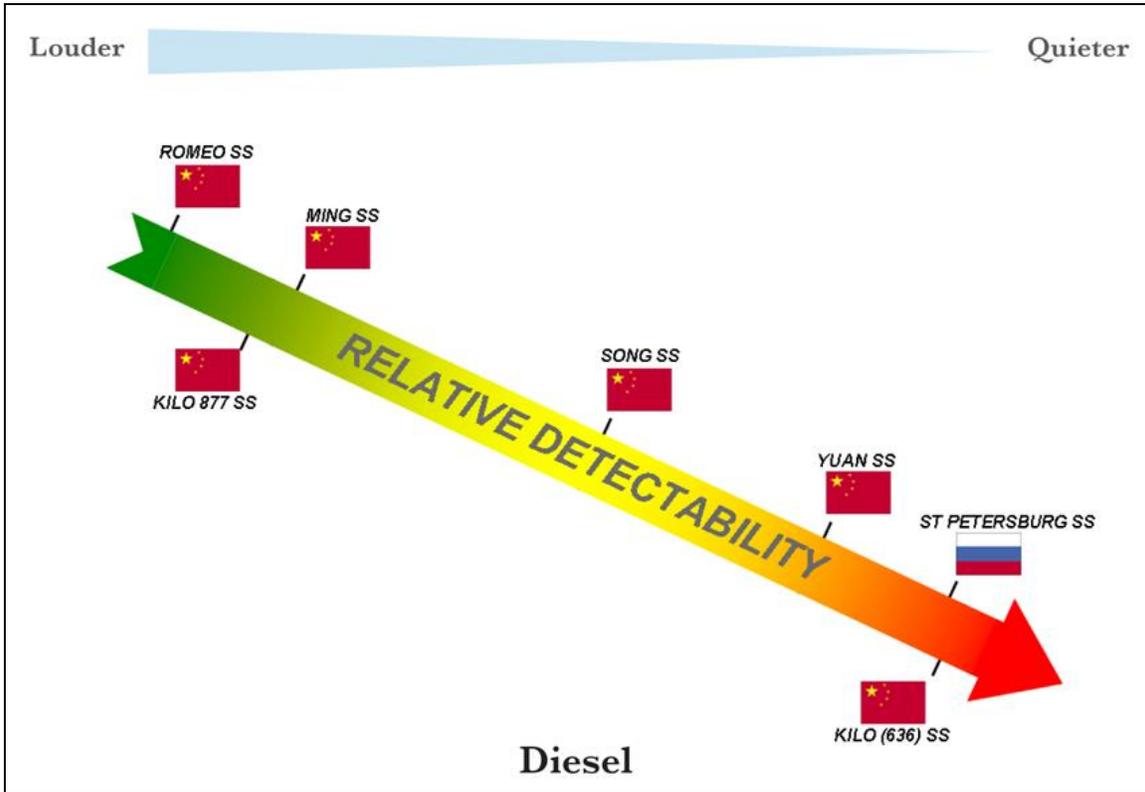
⁴⁴ See also Kyle Mizokami, “Are China’s Nuclear Subs Too Noisy for Their Own Good?” *Popular Mechanics*, January 29, 2018.

⁴⁵ For a discussion of Chinese torpedoes, see Charlie Gao, “China’s Torpedoes Are Built to Kill (but Just How Good Are They?),” *National Interest*, March 10, 2018.

⁴⁶ See Jeffrey Lin and P. W. Singer, “China’s New Submarine Engine Is Poised to Revolutionize Underwater Warfare,” *Popular Science*, June 2, 2017; Minnie Chan, “Why Chinese Submarines Could Soon Be Quieter Than US Ones,” *South China Morning Post*, July 4, 2017; Dave Majumdar, “DiD China Just Create the ‘Holy Grail’ Of Submarine Technologies?” *National Interest*, July 6, 2017; Dave Majumdar, “China’s Submarine Dream (And Nightmare for the U.S. navy): ‘Hunt for Red October’ Subs,” *National Interest*, July 6, 2017; James Holmes, “Why the U.S. Navy Shouldn’t Fear China’s ‘Hunt for Red October’ Missile Submarines,” *National Interest*, July 21, 2017; Cao Siqi, (continued...)

Figure 4. Acoustic Quietness of Chinese and Russian Non-Nuclear-Powered Submarines

(Non-nuclear-powered submarines are commonly referred to as diesel or diesel-electric submarines)



Source: 2009 ONI Report, p. 22.

Ballistic Missile Submarines

Regarding ballistic missile submarines, a January 10, 2017, press report states the following:

New photos of China's latest nuclear ballistic missile submarine, the “Jin” Type 094A, hints at a much-improved vessel—one that is larger, with a more pronounced “hump” rear of the sail that lets it carry 12 submarine-launched ballistic missiles.

First seen in late November 2016, the Type 094A differs from the previous four Type 094 SSBNs, what with its curved conning tower and front base that's blended into the submarine hull, possibly to reduce hydrodynamic drag. The Type 094A's conning tower has also removed its windows. Additionally, the Type 094A has a retractable towed array sonar (TAS) mounted on the top of its upper tailfin, which would make it easier for the craft to “listen” for threats and avoid them.

While the original Type 094 is considered to be noisier (and thus less survivable) than its American counterpart (the Ohio-class SSBN), the Type 094A is likely to include acoustic quieting technologies found on the Type 093A.⁴⁷

(...continued)

“Chinese Propulsion System Advances Submarine Capability,” *Global Times*, October 24, 2017.

⁴⁷ Jeffrey Lin and P.W. Singer, “China’s New Ballistic Missile Submarine Could Change Its Prospects in Nuclear (continued...)”

Nuclear-Powered Attack Submarines

Regarding nuclear-powered attack submarines, DOD states, “Over the next decade, China probably will construct a new variant of the SHANG class, the Type 093B guided-missile nuclear attack submarines (SSGN), which not only would improve the PLAN’s anti-surface warfare capability but might also provide it with a more clandestine land-attack option.”⁴⁸ ONI states that

The SHANG-class SSN’s initial production run stopped after only two hulls that were launched in 2002 and 2003. After nearly 10 years, China is continuing production with four additional hulls of an improved variant, the first of which was launched in 2012. These six total submarines will replace the aging HAN class SSN on nearly a one-for-one basis in the next several years. Following the completion of the improved SHANG SSN, the PLA(N) will progress to the Type 095 SSN, which may provide a generational improvement in many areas such as quieting and weapon capacity.⁴⁹

A June 27, 2016, blog post states the following:

Is China’s new Type 093B nuclear-powered attack submarine on par with the U.S. Navy’s Improved Los Angeles-class boats?

At least some U.S. naval analysts believe so and contend that the introduction of the new People’s Liberation Army Navy (PLAN) submarines is an indication of just how quickly Beijing is catching up to the West.

“The 93B is not to be confused with the 93. It is a transition platform between the 93 and the forthcoming 95,” said Jerry Hendrix, director of the Defense Strategies and Assessments Program at the Center for a New American Security—who is also a former U.S. Navy Captain. “It is quieter and it has a new assortment of weapons to include cruise missiles and a vertical launch capability. The 93B is analogous to our LA improved in quietness and their appearance demonstrates that China is learning quickly about how to build a modern fast attack boat.”

Other sources were not convinced that Beijing could have made such enormous technological strides so quickly—but they noted that the topic of Chinese undersea warfare capability is very classified. Open source analysis is often extremely difficult, if not impossible. “Regarding the question on the Type 093B, I really don’t know, anything is possible I suppose, but I doubt it,” said retired Rear Adm. Mike McDevitt, now an analyst at CNA’s Center for Naval Analyses. “I have no doubt that the PLAN has ambitions to at least achieve that level of capability and quietness.”⁵⁰

A February 4, 2018, press report states that

China is working to update the rugged old computer systems on nuclear submarines with artificial intelligence to enhance the potential thinking skills of commanding officers, a senior scientist involved with the programme told the South China Morning Post.

(...continued)

War,” *Popular Science*, January 10, 2017.

⁴⁸ 2017DOD CMSD, p. 24.

⁴⁹ 2015 ONI Report, p. 19. See also Lyle Goldstein, “Emerging From The Shadows,” *U.S. Naval Institute Proceedings*, April 2015: 30-34.

⁵⁰ Dave Majumdar, “Why the US Navy Should Fear China’s New 093B Nuclear Attack Submarine,” *National Interest*, June 27, 2016. See also Jeffrey Lin and P.W. Singer, “First Picture Of China’s Secretive New Submarine,” *Popular Science*, June 23, 2016. For additional discussion of the improved Type 093 boats, see Franz-Stefan Gady, “China’s ‘New’ Carrier Killer Subs,” *The Diplomat*, April 6, 2015; Kris Osborn, “China Unveils Three New Nuclear-Powered Attack Submarines,” *DefenseTech*, April 3, 2015; Zhao Lei, “Navy To Get 3 New Nuclear Subs,” *China Daily*, April 3, 2015.

A submarine with AI-augmented brainpower not only would give China's large navy an upper hand in battle under the world's oceans but would push applications of AI technology to a new level, according to the researcher, who spoke on condition of anonymity because of the project's sensitivity....

Joe Marino, CEO of Rite-Solutions, a technical company supporting the US Naval Undersea System Command, touted the value of using AI to enhance submarine commanding officers' decision-making powers.

"[Without matching other countries' advances in AI submarine technology] our CO (commanding officers) would be fighting an opponent who could make faster, more informed and better decisions," Marino wrote in an article on the company's website.

"Combined with undersea technology advancements by near-peer competitors such as Russia and China in areas such as stealth, sensors, weapons, this 'cognitive advantage' could threaten US undersea dominance," he wrote.⁵¹

Non-Nuclear-Powered Attack and Auxiliary Submarines

Some of China's newer non-nuclear-powered submarines reportedly are equipped with so-called air-independent propulsion (AIP) systems.⁵² Examples of AIP systems include fuel cells, Sterling engines, and close-cycle diesel engines. In comparison with traditional non-nuclear-powered submarines (i.e., diesel-electric submarines), which generally have a low-speed or stationary submerged endurance of a few days, AIP-equipped non-nuclear-powered submarines reportedly can have a low-speed or stationary submerged endurance of perhaps up to two or three weeks. (At high submerged speeds, both traditional and AIP-equipped non-nuclear-powered submarines drain their batteries quickly and consequently have a high-speed submerged endurance of perhaps a few hours.)

A January 5, 2017, press report states the following:

Images posted on Chinese online forums in December show three new Yuan-class (Type 039B) patrol submarines being fitted out in the water at the Wuchang Shipyard in Wuhan, central China: a clear indication that China has resumed production of these diesel-electric boats after a near-three-year hiatus.

The latest of the three submarines appears to have been launched around 12 December, [2016] according to online forums.⁵³

Although China's aged Ming-class (Type 035) submarines are based on old technology and are much less capable than China's newer-design submarines, China may decide that these older boats have continued value as minelayers or as bait or decoy submarines that can be used to draw out enemy submarines (such as U.S. SSNs) that can then be attacked by other Chinese naval forces.

China in 2012 commissioned into a service a new type of non-nuclear-powered submarine, called the Type 032 or Qing class according to *IHS Jane's Fighting Ships 2017-2018*, that is about one-

⁵¹ Stephen Chen, "China's Plan to Use Artificial Intelligence to Boost the Thinking Skills of Nuclear Submarine Commanders," *South China Morning Post*, February 4, 2018.

⁵² See, for example, "Expert: China's Submarine AIP Technology Not Inferior In Any Way," *China Military Online*, July 6, 2017.

⁵³ Andrew Tate, "China Resumes Production of Yuan-Class Submarines," *IHS Jane's 360*, January 5, 2017.

third larger than the Yuan-class design. Observers believe the boat may be a one-of-kind test platform; *IHS Jane’s Fighting Ships 2017-2018* refers to it as an auxiliary submarine (SSA).⁵⁴

A June 29, 2015, press report showed a 2014 satellite photograph of an apparent Chinese mini- or midget-submarine submarine that “has not been seen nor heard of since.”⁵⁵

Submarine Acquisition Rate and Potential Submarine Force Size

Table 1 shows actual and projected commissionings of Chinese submarines by class since 1995, when China took delivery of its first two Kilo-class boats. The table includes the final nine boats in the Ming class, which is an older and less capable submarine design.

Table 1. PLA Navy Submarine Commissionings
Actual (1995-2016) and Projected (2017-2019)

	Jin (Type 094) SSBN	Shang (Type 093/ 093A) SSN	Kilo SS (Russian- made)	Ming (Type 035) SS ^a	Song (Type 039/039G) SS	Yuan (Type 039A/B/C) SS ^b	Qing (Type 032) SS	Annual total for all types shown	Cumulative total for all types shown	Cumulative total for modern attack boats ^c
1995			2 ^d	1				3	3	2
1996				1				1	4	2
1997			1	2				3	7	3
1998			1	2				3	10	4
1999					1			1	11	5
2000				1				1	12	5
2001				1	2			3	15	7
2002				1				1	16	7
2003					2			2	18	9
2004			1		3			4	22	13
2005			6		3			9	31	22
2006		1	1		2	1		5	36	27
2007	1	1						2	38	28
2008								0	38	28
2009						2		2	40	30
2010	1					1		2	42	31
2011						3		3	45	34
2012	1					5	1 ^e	7	52	39
2013								0	52	39
2014								0	52	39
2015	1					2 ^f		3	55	41
2016		2 ^h						2	57	43
2017		n/a				n/a		n/a	n/a	n/a
2018	1 ^g	n/a				n/a		n/a	n/a	n/a
2019		n/a				n/a		n/a	n/a	n/a

Source: *IHS Jane’s Fighting Ships 2017-2018*, and (for Ming class) previous editions.

Note: n/a = data not available.

- a. Figures for Ming-class boats are when the boats were launched (i.e., put into the water for final construction). Actual commissioning dates for these boats may have been later.
- b. Some sources refer to the Yuan class as the Type 041.

⁵⁴ *IHS Jane’s Fighting Ships 2017-2018*, p. 140.

⁵⁵ Jamie Seidel, “Mini Submarine Captured on Satellite Photo of Chinese Dockyard,” *News.com.au*, June 29, 2015.

- c. This total excludes the Jin-class SSBNs (because they are not attack boats), the Ming-class SSs (because they are generally considered to not be of a modern design), and the Qing-class boat (because IHS Jane's considers it to be an auxiliary submarine).
- d. *IHS Jane's Fighting Ships 2017-2018* lists the commissioning date of one of the two Kilos as November 15, 1994.
- e. Observers believe this boat may be a one-of-kind test platform; *IHS Jane's Fighting Ships 2017-2018* refers to it as an auxiliary submarine (SSA).
- f. *IHS Jane's Fighting Ships 2017-2018* states that a class of 20 boats is expected.
- g. *IHS Jane's Fighting Ships 2017-2018* states that a total of five boats are expected, with the final four boats built to a modified (Type 093A) design.
- h. *IHS Jane's Fighting Ships 2017-2018* states that a total of six boats is expected.

As shown in **Table 1**, China by the end of 2016 was expected to have a total of 43 relatively modern attack submarines—meaning Shang-, Kilo-, Yuan-, and Song-class boats—in commission. As shown in the table, much of the growth in this figure occurred in 2004-2006, when 18 attack submarines (including 8 Kilo-class boats and 8 Song-class boats) were added, and in 2011-2012, when 8 Yuan-class attack submarines were added.

The figures in **Table 1** show that between 1995 and 2016, China was expected to place into service a total of 57 submarines of all kinds, or an average of about 2.6 submarines per year. This average commissioning rate, if sustained indefinitely, would eventually result in a steady-state submarine force of about 52 to 78 boats of all kinds, assuming an average submarine life of 20 to 30 years. A May 16, 2013, press report quotes Admiral Samuel Locklear, then-Commander of U.S. Pacific Command, as stating that China plans to acquire a total of 80 submarines.⁵⁶

As shown in **Table 1**, most of the submarines built in China have been non-nuclear-powered submarines. By contrast, as shown in the first two data columns of **Table 1**, China has built nuclear-powered submarines in small numbers and at annual rates of less than one per year.

Excluding the 12 Kilos purchased from Russia, the total number of domestically produced submarines placed into service between 1995 and 2016 is 44, or an average of 2.05 per year. This average rate of domestic production, if sustained indefinitely, would eventually result in a steady-state force of domestically produced submarines of about 41 to 61 boats of all kinds, again assuming an average submarine life of 20 to 30 years.

Projections of potential the size of China's submarine force in 2020 include the following:

- DOD states that “By 2020, [China's submarine] force will likely grow to between 69 and 78 submarines.”⁵⁷
- ONI stated in 2015 that “by 2020, the [PLA(N)] submarine force will likely grow to more than 70 submarines.”⁵⁸ In an accompanying table, ONI provided a more precise projection of 74 submarines in 2020, including 11 nuclear-powered boats and 63 non-nuclear-powered boats.⁵⁹
- An October 4, 2017, blog post from two nongovernment observers projects that China's submarine force in 2020 will include a total of 58 boats, including four Jin-class (Type-094) SSBNs, six Shang-class SSNs (two Type 093 and four Type

⁵⁶ Richard Halloran, “China, US Engaging in Underwater Arms Race,” *Taipei Times*, May 16, 2013: 8, accessed May 17, 2013, at <http://www.taipetimes.com/News/editorials/archives/2013/05/16/2003562368>.

⁵⁷ 2017 DOD CMSD, p. 24.

⁵⁸ 2015 ONI Report, p. 19.

⁵⁹ 2015 ONI Report, p. 18.

093A), and 48 SSs (20 Yuan-class boats, 12 Song-class boats, 12 Kilo-class boats, and four Ming-class boats).⁶⁰

JL-2 SLBM on Jin-Class SSBN

A December 9, 2015, press report stated that China had sent a Jin-class SSBN out on its first deterrent patrol.⁶¹ Each Jin-class SSBN is expected to be armed with 12 JL-2 nuclear-armed submarine-launched ballistic missiles (SLBMs). DOD states that

China's four operational JIN-class SSBNs represent China's first credible, sea-based nuclear deterrent. China's next-generation Type 096 SSBN, will likely begin construction in the early-2020s, and reportedly will be armed with the JL-3, a follow-on SLBM.⁶²

A range of 7,400 km for the JL-2 SLBM 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 midocean locations west of Hawaii; and
- targets in all 50 states from midocean locations east of Hawaii.

China reportedly is developing a new SLBM, potentially to be called the JL-3, as a successor to the JL-2.⁶³

Mines

China has modernized its substantial inventory of naval mines.⁶⁴ ONI states that

China has a robust mining capability and currently maintains a varied inventory estimated at more than 50,000 [naval] mines. China has developed a robust infrastructure for naval mine-related research, development, testing, evaluation, and production. During the past few years, China has gone from an obsolete mine inventory, consisting primarily of pre-WWII vintage moored contact and basic bottom influence mines, to a vast mine inventory consisting of a large variety of mine types such as moored, bottom, drifting, rocket-propelled, and intelligent mines. The mines can be laid by submarines (primarily for covert mining of enemy ports), surface ships, aircraft, and by fishing and merchant vessels. China will continue to develop more advanced mines in the future such as extended-range propelled-warhead mines, antihelicopter mines, and bottom influence mines more able to counter minesweeping efforts.⁶⁵

⁶⁰ Henry Boyd and Tom Waldwyn, "China's Submarine Force: An Overview," IISS, October 4, 2017.

⁶¹ Bill Gertz, "Pentagon Confirms Patrols of Chinese Nuclear Missile Submarines," *Washington Times*, December 9, 2015. See also Richard D Fisher Jr., "China Advances Sea- and Land-Based Nuclear Deterrent Capabilities," *IHS Jane's Defence Weekly*, December 15, 2015.

⁶² 2017DOD CMSD, p. 24. See also *ONI Report*, pp. 19-20.

⁶³ Joseph Dempsey and Henry Boyd, "Beyond JL-2: China's Development of a Successor SLBM Continues," IISS, August 7, 2017.

⁶⁴ See, for example, Scott C. Truver, "Taking Mines Seriously, Mine Warfare in China's Near Seas," *Naval War College Review*, Spring 2012: 30-66.

⁶⁵ 2015 *ONI Report*, pp. 23-24.

Unmanned Underwater Vehicles (UUVs)

A July 26, 2017, press report states that “China is testing large-scale deployment of underwater drones in the South China Sea with real-time data transmission technology, a breakthrough that could help reveal and track the location of foreign submarines.” The report describes the work as an “effort by China to speed up and improve collection of deep-sea data in the South China Sea for its submarine fleet operation....”⁶⁶

Aircraft Carriers and Carrier-Based Aircraft⁶⁷

Overview

China’s first aircraft carrier entered service in 2012. China’s second aircraft carrier (and its first indigenously built carrier) was launched (i.e., put into the water for the final stages of construction) in April 2017 and reportedly began sea trials in April 2018. China reportedly has begun construction of a third aircraft carrier. Observers speculate China may eventually field a force of four to six aircraft carriers.⁶⁸ In September 2017, it was reported that China had hired a retired Ukrainian national whose prior work experience includes having assisted the Soviet Union’s efforts in building aircraft carriers.⁶⁹

First Carrier: *Liaoning* (Type 001)

On September 25, 2012, China commissioned into service its first aircraft carrier—the *Liaoning* or Type 001 design (**Figure 5**), a refurbished ex-Ukrainian aircraft carrier, previously named *Varyag*, that China purchased from Ukraine in 1998 as an unfinished ship.⁷⁰

The *Liaoning* is conventionally powered, has an estimated full load displacement of almost 60,000 tons,⁷¹ and might accommodate an eventual air wing of 30 or more aircraft, including fixed-wing airplanes and helicopters. A September 7, 2014, press report, citing an August 28, 2014, edition of the Chinese-language *Shanghai Morning Post*, stated that the *Liaoning*’s air wing

⁶⁶ Stephen Chen, “Why Beijing Is Speeding Up Underwater Drone Tests in the South China Sea,” *South China Morning Post*, July 26, 2017. See also Lyle J. Goldstein, “America May Soon Find Itself in an Underwater War with China,” *National Interest*, July 24, 2017. See also “Sea Sentinels: Chinese Unmanned Maritime Systems Gain traction,” *Jane’s*, 2018.

⁶⁷ China, according to one set of observers, initiated studies on possible aircraft carrier options in the 1990s, and approved a formal aircraft carrier program in 2004. (Andrew S. Erickson and Gabriel B. Collins, “The Calm Before the Storm,” *FP [Foreign Policy] National Security*, September 26, 2012.) Another observer dates Chinese activities in support of an eventual aircraft carrier program back to the 1980s. (Torbjorg Hemmingsen, “PLAN For Action: New Dawn for Chinese Naval Aviation,” *Jane’s Navy International*, June 2012: 12-17.) See also Andrew Scobell, Michael McMahon, and Cortez A. Cooper III, “China’s Aircraft Carrier Program,” *Naval War College Review*, Autumn 2015, pp. 65-79.

⁶⁸ See, for example, Jamie Seidel, “China Is About to Launch Its Second Aircraft Carrier, 001A,” *News.com.au*, March 6, 2017.

⁶⁹ Robert Beckhusen, “This Military Expert May Help China Even the Odds Against the U.S. Navy,” *National Interest*, September 6, 2017.

⁷⁰ The Soviet Union began work on the *Varyag* in a shipyard in Ukraine, which at the time was part of the Soviet Union. Following the dissolution of the Soviet Union, construction work on the ship stopped and the unfinished ship became the property of Ukraine. For a discussion, see James Holmes, “The Long Strange Trip of China’s First Aircraft Carrier,” *Foreign Policy*, February 3, 2015; Chen Chu-chun and Staff Reporter, “Man Who Bought Varyag From Ukraine Plied Officials With Liquor,” *Wanted China Times*, January 22, 2015.

⁷¹ *IHS Jane’s Fighting Ships 2017-2018* lists a full load displacement of 59,439 tons for the ship.

may consist of 24 J-15 fighters, 6 anti-submarine warfare helicopters, 4 airborne early warning helicopters, and 2 rescue helicopters, for a total of 36 aircraft.⁷² The *Liaoning* lacks aircraft catapults and instead launches fixed-wing airplanes off the ship's bow using an inclined "ski ramp."

Figure 5. *Liaoning* (Type 001) Aircraft Carrier



Source: "Highlights of Liaoning Carrier's One-Year Service," *China Daily*, September 26, 2013, accessed September 30, 2013, at http://www.china.org.cn/china/2013-09/26/content_30142217.htm. This picture shows the ship during a sea trial in October 2012.

By comparison, a U.S. Navy aircraft carrier is nuclear powered (giving it greater cruising endurance than a conventionally powered ship), has a full load displacement of about 100,000 tons, can accommodate an air wing of 60 or more aircraft, including fixed-wing aircraft and some helicopters, and launches its fixed-wing aircraft over both the ship's bow and its angled deck using catapults, which can give those aircraft a range/payload capability greater than that of aircraft launched with a ski ramp. The *Liaoning*, like a U.S. Navy aircraft carrier, lands fixed-wing aircraft using arresting wires on its angled deck. Some observers have referred to the *Liaoning* as China's "starter" carrier.⁷³ DOD states that "When fully operational, Liaoning will be less capable than the U.S. Navy's NIMITZ-class carriers in projecting power. Its smaller size limits the number of aircraft it can embark and the ski-jump configuration limits aircraft fuel and ordnance loads."⁷⁴ ONI states that

⁷² Wendell Minnick, "Chinese Carrier's Purported Air Wing Deemed Plausible But Limited," *Defense News* (www.defensenews.com), September 7, 2014.

⁷³ See, for example, *2015 ONI Report*, p. 23, and "China Plans New Generation of Carriers as Sea Disputes Grow," *Bloomberg News*, April 24, 2013.

⁷⁴ *2017 DOD CMSD*, p. 26.

LIAONING is quite different from the U.S. Navy's NIMITZ-class carriers. First, since LIAONING is smaller, it will carry far fewer aircraft in comparison to a U.S.-style carrier air wing. Additionally, the LIAONING's ski-jump configuration significantly restricts aircraft fuel and ordnance loads. Consequently, the aircraft it launches have more a limited flight radius and combat power. Finally, China does not yet possess specialized supporting aircraft such as the E-2C Hawkeye.⁷⁵

The PLA Navy is currently learning to operate aircraft from the ship. ONI states that "full integration of a carrier air regiment remains several years in the future, but remarkable progress has been made already,"⁷⁶ and that "it will take several years before Chinese carrier-based air regiments are operational."⁷⁷ A September 2, 2015, press report states that "China's aircraft carrier *Liaoning* can carry at least 20 fixed-wing carrier-based J-15 fighter jets and the ratio between the pilots and planes is about 1.5:1. So China needs to train more pilots for the future aircraft carrier, said a military expert recently."⁷⁸

In November 2016, the ship was reportedly described as being ready for combat.⁷⁹ An October 26, 2017, press report states that "despite its inauguration in 2012, it appears the vessel's genuine war-readiness is still in doubt."⁸⁰

Second Carrier: Type 001A

China's second aircraft carrier (and its first indigenously built carrier), referred to as the Type 001A design (**Figure 6**), was launched (i.e., put into the water for the final stages of construction) on April 26, 2017,⁸¹ and reportedly began its first sea trial on April 23, 2018, a date that observers noted was the anniversary of establishment of the PLAN.⁸²

The ship—which reportedly might be given the name *Shandong*, for the Chinese province—is thought to be a modified version of the *Liaoning* design that incorporates some design improvements. A December 11, 2017, press report states that the ship may embark up to 35 J-15 carrier-based fighters, as opposed to 24 on the *Liaoning*.⁸³

Third Carrier (Type 002) and Subsequent Carriers

As stated earlier, observers speculate China may eventually field a force of four to six aircraft carriers, meaning *Liaoning*, the Type 001A carrier, and two to four additional carriers. Press reports state that China's third and subsequent carriers may use catapults rather than ski ramps,

⁷⁵ 2015 ONI Report, p. 23.

⁷⁶ 2015 ONI Report, p. 13.

⁷⁷ 2015 ONI Report, p. 23.

⁷⁸ "Over 20 J-15 Fighters Can Land on the Liaoning Aircraft Carrier," *People's Daily Online*, September 7, 2015.

⁷⁹ Associated Press, "China Says Aircraft Carrier Now Ready for Combat," *Washington Post*, November 15, 2016; Jesse Johnson, "China Says Its First Aircraft Carrier Is Now 'Combat Ready,'" *Japan Times*, November 15, 2016.

⁸⁰ Asia Unhedged, "Refurbished Carrier Is Not Combat-Ready, Experts Say," *Asia Times*, October 26, 2017.

⁸¹ See, for example, Chris Buckley, "China Launches Its First Aircraft Carrier Built at Home," *New York Times*, April 25, 2017; "China Launches Aircraft Carrier, Boosting Military Presence," *BBC News*, April 25, 2017; Minnie Chan, "China Launches First Home-Built Aircraft Carrier in Latest Display of Growing Naval Power," *South China Morning Post*, April 26, 2017; Charles Clover, "China Launches First Home-Built Aircraft Carrier," *Financial Times*, April 26, 2017.

⁸² Asia Times staff, "China's First Homemade Carrier Out for Maiden Sea Trial," *Asia Times*, April 24, 2018.

⁸³ Minnie Chan, "What Are the Differences Between China's Two Aircraft Carriers?" *South China Morning Post*, December 11, 2017.

that the catapults might be new-technology electromagnetic catapults rather than traditional steam-powered catapults, and that at least some of the ships might be nuclear-powered rather than conventionally powered.

Figure 6. Type 001A Aircraft Carrier

Picture dated April 26, 2017



Source: Photo captioned “China officially launches its second—and the first domestically developed—aircraft carrier on Apr 26, 2017, in Dalian, Liaoning province,” sixth of six photos accompanying Zhao Lei, “China Launches First Domestically Developed Aircraft Carrier,” *China Daily*, April 26, 2017.

A March 1, 2018, press report states the following:

One of China’s largest shipbuilders has revealed plans to speed up the development of China’s first nuclear-powered aircraft carrier, as part of China’s ambition to transform its navy into a blue-water force by the middle of the next decade.

In a since-amended news release outlining the company’s future strategic direction in all of its business areas, the state-owned China Shipbuilding Industry Corporation, or CSIC, said the shipbuilding group will redouble efforts to achieve technological breakthroughs in nuclear-powered aircraft carriers, new nuclear-powered submarines, quieter conventionally powered submarines, underwater artificial intelligence-based combat systems and integrated networked communications systems....

The company release added that these breakthroughs are required for China’s People’s Liberation Army Navy, or PLAN, to enhance its capability to globally operate in line with the service’s aim to become a networked, blue-water navy by 2025.

The original news release, which Defense News has seen and translated, has since been deleted from CSIC’s website and replaced by one missing all references to the details listed above.⁸⁴

Another March 1, 2018, press report states the following:

⁸⁴ Mike Yeo, “China to develop its first nuclear-powered aircraft carrier,” *Defense News*, March 1, 2018.

China is ready to build larger aircraft carriers having mastered the technical ability to do so, a major state-run newspaper said on Friday [March 2] ahead of the release of the country's annual defense budget....

Liu Zheng, chairman of Dalian Shipbuilding Industry in Liaoning province, said his company and its parent, China Shipbuilding Industry Corp, the world's largest shipbuilder, could design and build carriers.

"We have complete ownership of the expertise, in terms of design, technology, technique, manufacturing and project management, that is needed to make an advanced carrier," Liu told the official China Daily ahead of Monday's opening of the annual session of parliament.

"We are ready to build larger ones," he said.

China Shipbuilding said earlier this week they were developing technologies to build a nuclear-powered aircraft carrier.⁸⁵

A January 19, 2018, press report states the following:

China's third aircraft carrier is under construction and will likely see several technological improvements over the country's first two. The ship, known for now only as 002, has been under construction since 2015. The new carrier will likely be larger than her predecessors and sport an electromagnetic launch system for aircraft, allowing for larger, heavier aircraft to conduct longer distance flights with more weaponry....

The third aircraft carrier, 002, began construction in March 2015 at the Jiangnan Changxingdao Shipyard in Shanghai. The first two ships were studied and built as learning experiences with minimal changes or improvements. The third ship, however, is expected to be substantially different.

One of the major differences between the three carriers is size. The first carrier, Liaoning, was locked into the size of the existing 67,000 ton hull. The second carrier is expected to be about the same size, as China learned how to make a copy of an aircraft carrier. The third carrier is expected to tip the scales at about 80,000 tons, and 002 will also likely be slightly longer than Liaoning's 999 feet.

A larger carrier will mean several things. 002 will carry more fuel, both for its aircraft and itself, enabling the carrier to operate farther from China and the aircraft to fly more sorties from the carrier. The newer, larger carrier will also have more room for aircraft, both in the hangar and on the flight deck itself. The second carrier, 001A, has a smaller island than Liaoning, freeing up deck space, and 002 will likely shrink her island even more.

As a result, the carrier's air wing can be expected to grow substantially larger. Liaoning can carry up to 24 Shenyang J-15 "Flying Shark" multi-role fighters, while 001A will probably increase that to 30 J-15s. 002's air wing could grow to 40 fighters plus a handful of propeller-driven carrier onboard delivery transports and airborne early warning aircraft....

Another major difference is that, unlike Liaoning and 001A, 002 is expected ditch the bow-mounted ski ramp and use an aircraft catapult launching system....

⁸⁵ "China Ready to Build Larger Aircraft Carriers, Paper Says," *Reuters*, March 1, 2018. See also Liu Zhen, "China Aims for Nuclear-Powered Aircraft Carrier by 2025," *South China Morning Post*, February 28, 2018, updated March 1, 2018; Shunsuke Tabeta, "China's Plans for First Nuclear Carrier Revealed," *Nikkei Asian Review*, March 1, 2018; Asia Times staff, "China Eyes Building Nuclear-Powered Aircraft Carriers," *Asia Times*, March 2, 2018.

China is reportedly skipping over steam-driven aircraft catapults to instead build an electromagnetic aircraft launching system (EMALS), similar to that recently put into service on the U.S. Navy's newest carrier, USS Gerald R. Ford. A report from Defense News in November 2017 stated that Chinese leader Xi Jinping had wanted EMALS installed on 002, but engineers couldn't reconcile a conventional power plant with the huge power demands of the electromagnetic launch system. Chinese naval engineers have now apparently solved the power issue....

002 will undoubtedly come with other improvements. A more robust air defense weapons suite is likely, with close-in weapons such as the HQ-10 Flying Leopard short-range air defense system similar to the American RIM-116 Rolling Airframe Missile (RAM). Passive anti-missile and anti-torpedo defenses will be expanded to give the ship a fighting chance under attack. Expanded medical and water desalination capabilities, already a necessity, could make the ship useful in humanitarian assistance and disaster relief missions as American carriers already are.⁸⁶

A January 4, 2018 press report updated on January 5, 2018, states the following:

China started building its third aircraft carrier, with a hi-tech launch system, at a Shanghai shipyard last year, according to sources close to the People's Liberation Army.

One of the sources said Shanghai Jiangnan Shipyard Group was given the go-ahead to begin work on the vessel after military leaders met in Beijing following the annual sessions of China's legislature and top political advisory body in March.

"But the shipyard is still working on the carrier's hull, which is expected to take about two years," the source said. "Building the new carrier will be more complicated and challenging than the other two ships."...

The sources all said it was too early to say when the third vessel would be launched, but China plans to have four aircraft carrier battle groups in service by 2030, according to naval experts.

Shipbuilders and technicians from Shanghai and Dalian are working on the third vessel, which will have a displacement of about 80,000 tonnes – 10,000 tonnes more than the Liaoning, according to another source close to the PLA Navy.

"China has set up a strong and professional aircraft carrier team since early 2000, when it decided to retrofit the Varyag [the unfinished vessel China bought from Ukraine] to launch as the Liaoning, and it hired many Ukrainian experts ... as technical advisers," the second source said.

The sources also confirmed that the new vessel, the CV-18, will use a launch system that is more advanced than the Soviet-designed ski-jump systems used in its other two aircraft carriers.

Its electromagnetic aircraft launch system will mean less wear and tear on the planes and it will allow more aircraft to be launched in a shorter time than other systems....

Sources said the layout of the new aircraft carrier, including its flight deck and "island" command centre, would be different from the other two.

⁸⁶ Kyle Mizokami, "China's Next Aircraft Carrier Will Be a Massive Leap Forward," *Popular Mechanics*, January 19, 2018. See also Guo Yuandan and Liu Xin, "China Likely to Use Electromagnetic Catapult on 3rd Carrier," *Global Times*, January 18, 2018.

“The new vessel will have a smaller tower island than the Liaoning and its sister ship because it needs to accommodate China’s carrier-based J-15 fighter jets, which are quite large,” the first source said.⁸⁷

A March 15, 2018, press report states that following the Type 002 carrier design, China will begin building a Type 003 carrier design:

The biggest item in CSIC's [China Shipbuilding Industry Corporation's] not-so-secret portfolio is China's first nuclear-powered carrier. Popularly identified as the Type 003, it will be the largest non-American warship in the world when its launched in the late 2020s. CSIC's Dalian Shipyard, which refurbished the aircraft carrier Liaoning, and launched China's first domestically built carrier, CV-17, in 2017, will presumably build China's first "Type 003" CVN.

The Type 003 will displace between 90,000-100,000 tons and have electromagnetically assisted launch system (EMALS) catapults for getting aircrafts off the deck. It'll likely carry a large air wing of J-15 fighters, J-31 stealth fighters, KJ-600 airborne early warning and control aircraft, anti-submarine warfare helicopters, and stealth attack drones.⁸⁸

Carrier-Based Aircraft

China has developed a carrier-capable fighter, called the J-15 or Flying Shark, that can operate from the *Liaoning* (**Figure 7**).

⁸⁷ Minnie Chan, “China Has Started Building Its Third Aircraft Carrier, Military Sources Say,” *South China Morning Post*, January 4, 2018, updated January 5, 2018.

⁸⁸ Jeffrey Lin and P.W. Singer, “A Chinese Shipbuilder Accidentally Revealed Its Major Navy Plans,” *Popular Science*, March 15, 2018.

Figure 7. J-15 Carrier-Capable Fighter



Source: Zachary Keck, “China’s Carrier-Based J-15 Likely Enters Mass Production,” *The Diplomat* (<http://thediplomat.com>), September 14, 2013.

DOD states that the J-15 is “modeled after the Russian Su-33 [Flanker],” and that “although the J-15 has a land-based combat radius of 1,200 km, the aircraft will be limited in range and armament when operating from the carrier, because the ski-jump design does not provide as much airspeed and, therefore, lift at takeoff as a catapult design.”⁸⁹

A February 1, 2017, press report speculates that China may be developing a carrier-based airborne early warning and control aircraft broadly similar to the U.S. Navy’s E-2 Hawkeye carrier-based airborne early warning and control aircraft.⁹⁰

A November 19, 2017, press report states the following:

China spent more than a decade developing its first carrier-based fighter, the J-15, based on a prototype of a fourth-generation Russian Sukhoi Su-33 twin-engined air superiority fighter—a design that is now more than 30 years old.

The J-15, with a maximum take-off weight of 33 tonnes, is the heaviest active carrier-based fighter jet in the world but the sole carrier-based fighter in the People’s Liberation Army Navy....

“The maximum take-off weight of the J-15 fighter is 33 tonnes and experiments found that even the US Navy’s new generation C13-2 steam catapult launch engines, installed on Nimitz-class aircraft carriers, would struggle to launch the aircraft efficiently,” the source, who requested anonymity, said.

⁸⁹ 2014 DOD CMSD, p. 68. See also 2015 ONI Report, p. 23.

⁹⁰ Anki Panda, “An Early Warning Aircraft for China’s Carriers?” *The Diplomat*, February 1, 2017.

The US Navy also relied on a heavy carrier-based fighter in the past, the 33.7 tonne F-14 Tomcat. But they were replaced by the lighter F-18 Super Hornet in 2006 after 32 years of service. The maximum take-off weight of an F-18 Super Hornet is 29.9 tonnes according to the website of manufacturer Boeing.

China has been trying to develop a new generation carrier-based fighter, the FC-31, with a maximum take-off weight of 28 tonnes, to replace the J-15, and put J-15 chief designer Sun Cong in charge of the project.

Pictures posted on mainland military websites show that Shenyang Aircraft Corporation, the manufacturer of the J-15, has produced two FC-31 prototypes, with one debuting at the Zhuhai air show in 2014.

However, the two military sources said, the development of the FC-31 had not proceeded smoothly and it had failed to meet the PLA Navy's requirements, with the key obstacle being what one described as "heart disease".

"China is still incapable of developing an engine for the FC-31 fighter," the first source said. "The FC-31 has needed to be equipped with Russian RD-93 engines for test flights."

The second source said the FC-31's failure to meet the PLA Navy's basic requirements for a new generation fighter meant "that in the next two decades, the J-15 will still be the key carrier-based fighter on China's aircraft carriers".⁹¹

A December 6, 2017, press report states the following:

China's future straight-deck aircraft carriers with the electromagnetic launcher system will carry fifth-generation jet fighters like [the] J-20 and J-31, Chinese experts said on Wednesday [December 6]....

The J-20 and J-31 will surely be installed on future Chinese aircraft carriers with the catapult system, to protect the carriers, Yin Zhuo, a senior researcher at the PLA Naval Equipment Research Center, told the Military Time.

Yin predicted the J-15 fighters on the Type 001A will be around 40, about the same as that for Liaoning ship.

Song Zhongping, a TV commentator and military expert, told the Global Times that "It is more likely that J-15 fighters and improved versions will be on board together with stealth fighters such as the J-20 and J-31, as they will be playing different roles."

However, Song pointed out that since the J-20 and J-31 are primarily designed for the air force, adapting them as navy fighters will entail some costs. "The J-20 will be more expensive to modify than the J-31."⁹²

A January 23, 2018, press report states the following:

China's carrier aviation programs continue apace with the focus starting to shift toward the development and introduction of training and specialized aircraft as China's first domestically built carrier approaches the start of sea trials....

Currently, the PLAN only has a single type of fixed-wing carrierborne aircraft in service. This is the Shenyang J-15 Flying Shark multirole fighter....

⁹¹ Minnie Chan, "China's Aircraft Carrier Conundrum: Hi-Tech Launch System for Old, Heavy Fighters," *South China Morning Post*, November 19, 2017.

⁹² Deng Xiaoci, "Future Chinese Aircraft Carriers to Feature J-20, J-31 Stealth Fighters," *Global Times*, December 6, 2017.

Approximately two dozen J-15s have been produced so far in two production batches, and these are currently only able to operate from the ski jump-equipped Liaoning aircraft carrier and the Type 002 carrier being fitted out in the city of Dalian.

China is known to have at least one of the six J-15 prototypes fitted with catapult launch accessories on its nose landing gear, and the country is carrying out catapult tests with this aircraft, using what are believed to be a steam catapult and EMALS at an air base near Huludao, Liaoning province in northern China.

In addition, China is developing a twin-seat variant of the J-15, with at least a single prototype known to be flying from Shenyang Aircraft Corporation's facilities located in its namesake city. It is likely this variant, designated the J-15S, will operate from the future, catapult-equipped carrier China will build after the Type 002 as a two-seat multirole fighter alongside single-seat J-15s, much like the mix of single-seat Boeing F/A-18E Super Hornets and twin-seat F/A-18Fs onboard a typical U.S. Navy carrier air wing.

Future production batches of J-15s are also expected to be fitted with more modern avionics, such as those already fitted to the J-16 fighter that will include an active electronically scanned array radar.

The electronic warfare/electronic attack technology being developed for a specialized variant of the J-16 may also be introduced on the J-15.

However, these are unlikely to be fielded in the near term, but rather are expected to enter service in the early part of the next decade, at the earliest...

The PLAN is also revamping its pilot training program with the intention of streamlining the process of training its pilots. The service sees an urgent need for 400 new pilots in the coming years with the introduction of new land- and carrier-based aircraft types...

However, the PLAN lacks a dedicated trainer aircraft used to qualify carrier pilots, with the J-15 currently being used in this role. An attempt was made to develop a carrier trainer version of the JL-9 for this purpose, but this was unsuccessful; reports suggest the JL-9's fuselage was unable to cope with the stress involved in arrested landings onboard carriers....

As Defense News previously reported, if China were to build its third carrier equipped with an EMALS as expected, the PLAN will be able to operate a wider variety of aircraft from its carriers, opening up the possibility of equipping its air wings with an aircraft similar to the Northrop Grumman E-2 Hawkeye airborne early-warning aircraft.

The PLAN's current shipboard airborne early-warning asset is the Changhe Z-8 helicopter fitted with a radar that can be stowed when not in use....

China previously built a mock-up of a Xi'an Y-7 with a heavily modified tailplane and a radar rotodome on top of its fuselage around the year 2010. Yet, there has been no further development of that project since then.

A similar mock-up was seen on the carrier flight deck test bed at a naval testing facility in Wuhan, Hubei province, in early 2017, indicating that China is still interested in developing such a platform.⁹³

Press reports dated April 3 and 4, 2018, stated that China is developing carrier based UAVs.⁹⁴

⁹³ Mike Ywo, "No SLOWdown for China's Navy Aspirations," *Defense News*, January 23, 2018. See also "PLA Navy to Streamline Pilot Training as More Aircraft Carriers Expected," *Global Times*, January 8, 2018; Minnie Chan, "Chinese Navy Trains More Fighter Pilots for Expanded Aircraft Carrier Fleet," *South China Morning Post*, January 2, 2018.

Potential Roles, Missions, and Strategic Significance

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 be used for power-projection operations, particularly in scenarios that do not involve opposing U.S. forces, and to impress or intimidate foreign observers.⁹⁵ 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,⁹⁶ but conducting such attacks could divert U.S. ships and aircraft from performing other missions in a conflict situation with China.⁹⁷

DOD states that

Liaoning will probably focus on fleet air defense missions, extending air cover over a fleet operating far from land-based coverage. It probably also will play a significant role in developing China's carrier pilots, deck crews, and tactics for future carriers.⁹⁸

DOD also states that

Last year, China continued to learn lessons from operating its first aircraft carrier, Liaoning, while constructing its first domestically produced aircraft carrier—the beginning of what the PLA states will be a multi-carrier force. China's next generation of carriers will probably have greater endurance and be capable of launching more varied types of aircraft, including EW, early warning, and ASW aircraft. These improvements would increase the potential striking power of a potential "carrier battle group" in safeguarding China's interests in areas beyond its immediate periphery; it would also be able to protect nuclear ballistic missile submarines stationed on Hainan Island in the South China Sea. The carriers would most likely also perform such missions as patrolling

(...continued)

⁹⁴ Yang Sheng, "Government Support Needed for Carrier-Based UAVs 'To Build Powerful Navy,'" *Global Times*, April 3, 2018; Asia Times staff, "Carrier-Based Attack Drones to Enter Service with LPA Navy," April 4, 2018.

⁹⁵ 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.

⁹⁶ See, for example, James Holmes, "Revealed: How the US Navy Would Destroy a Chinese Aircraft Carrier," *Asia Times*, May 31, 2016.

⁹⁷ For further discussion, see Andrew Erickson and Gabe Collins, "The 'Flying Shark' Prepares to Roam the Seas: pros and cons [for China] of China's aircraft carrier program," *China SignPost*, May 18, 2011, 5 pp.; Aaron Shraberg, "Near-Term Missions for China's Maiden Aircraft Carrier," *China Brief*, June 17, 2011: 4-6; and Andrew S. Erickson, Abraham M. Denmark, and Gabriel Collins, "Beijing's 'Starter Carrier' and Future Steps," *Naval War College Review*, Winter 2012: 15-55; Robert Farley, "China's Aircraft Carriers and Nuclear Bastion Defense," *The Diplomat*, May 11, 2017.

⁹⁸ 2017 DOD CMSD, p. 31.

economically important SLOCs, conducting naval diplomacy, regional deterrence, and HA/DR operations.⁹⁹

ONI states that

Unlike a U.S. carrier, LIAONING is not well equipped to conduct long-range power projection. It is better suited to fleet air defense missions, where it could extend a protective envelope over a fleet operating in blue water. Although it possesses a full suite of weapons and combat systems, LIAONING will likely offer its greatest value as a long-term training investment.¹⁰⁰

Navy Surface Combatants and Coast Guard Cutters¹⁰¹

Overview

China since the early 1990s has purchased four Sovremenny-class destroyers from Russia and put into service 10 new classes of indigenously built destroyers and frigates (some of which are variations of one another) that demonstrate a significant modernization of PLA Navy surface combatant technology. DOD states that “The PLAN also remains engaged in a robust surface combatant construction program that will provide a significant upgrade to the PLAN’s air defense capability. These assets will be critical as the PLAN expands operations into distant seas beyond the range of shore-based air defense systems.”¹⁰² ONI states that

In recent years, shipboard air defense is arguably the most notable area of improvement on PLA(N) surface ships. China has retired several legacy destroyers and frigates that had at most a point air defense capability, with a range of just several miles. Newer ships entering the force are equipped with medium-to-long range area air defense missiles.¹⁰³

China is also building a new class of cruiser (or large destroyer) and a new class of corvettes (i.e., light frigates), and previously put into service a new kind of missile-armed fast attack craft that uses a stealthy catamaran hull design. ONI states, “The JIANGKAI-class (Type 054A) frigate series, LUYANG-class (Type 052B/C/D) destroyer series, and the upcoming new cruiser (Type 055) class are considered to be modern and capable designs that are comparable in many respects to the most modern Western warships.”¹⁰⁴

A June 1, 2017, press report states that China is exploring potential design concepts for submersible or semi-submersible arsenal ships—ships equipped with large numbers of missiles that that could operate with part or most of their hulls below the waterline so as to reduce their detectability.¹⁰⁵

⁹⁹ 2017 DOD CMSD, p. 53.

¹⁰⁰ 2015 ONI Report, p. 23.

¹⁰¹ For additional information on China’s surface combatants, see Peter A. Dutton and Ryan D. Martinson, eds., *China’s Evolving Surface Fleet*, U.S. Naval War College, July 2017, 131 pp. (China Maritime Studies Institute, Number 14.)

¹⁰² 2017 DOD CMSD, p. 25.

¹⁰³ 2015 ONI Report, p. 15.

¹⁰⁴ 2015 ONI Report, p. 13.

¹⁰⁵ Jeffrey Lin and P.W. Singer, “China Is Developing a Warship of Naval Theorists’ Dreams,” *Popular Science*, June 1, 2017. For reports on a somewhat similar concept that was pursued by the U.S. Navy for a brief time in the 1990s, see CRS Report 97-455 F, *Navy/DARPA Arsenal Ship Program: Issues and Options for Congress*, by Ronald O’Rourke, April 18, 1997; and CRS Report 97-1044 F, *Navy/DARPA Maritime Fire Support Demonstrator (Arsenal Ship) Program: Issues Arising From Its Termination*, by Ronald O’Rourke, December 10, 1997 (not distributable online but (continued...))

China is also building substantial numbers of new cutters for the China Coast Guard (CCG), which China often uses for asserting and defending its maritime territorial claims in the East and South China Seas. In terms of numbers of ships being built and put into service, production of corvettes for China's navy and cutters for the CCG are currently two of China's most active areas of noncommercial shipbuilding. Russia reportedly has assisted China's development of new surface warfare capabilities.¹⁰⁶

New Renhai (Type 055) Cruiser (or Large Destroyer)

China is building a new class of cruiser (or large destroyer), called the Renhai-class or Type 055 (**Figure 8**), that reportedly displaces roughly 10,000 tons to 12,000 tons. A November 3, 2017, press report states that "an expert with the PLA Naval University of Engineering revealed at a forum at the end of last month that the nation's first super-destroyer, [had dimensions of] 186 meters [about 610 feet] long and 21 meters [about 69] wide with a displacement of up to 12,300 tons...."¹⁰⁷ 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 Zumwalt (DDG-1000) class destroyers displace about 15,600 tons.

DOD refers to the Type 055 design as a cruiser. China is the only country known to be planning to build a ship referred to (by some sources at least) as a cruiser.¹⁰⁸ (The U.S. Navy's current 30-year shipbuilding plan includes destroyers but no cruisers.) The Type 055 is expected to be equipped with sensors and weapons broadly similar to those on China's newest indigenously built destroyers (see next section). Since the Type 055 is larger than those destroyers, it will likely carry a larger total number of weapons.

(...continued)

available from the author).

¹⁰⁶ Paul Schwartz, *Russia's Contribution to China's Surface Warfare Capabilities, Feeding the Dragon*, Washington, Center for Strategic and International Studies, August 2015, 42 pp. For a press report based on this document, see Franz-Stefan Gady, "How Russia Is Helping China Develop Its Naval Power," *The Diplomat*, September 4, 2015.

¹⁰⁷ Asia Times Staff, "More Details of PLA's Ace Type 055 Destroyer Unveiled," *Asia Times*, November 3, 2017.

¹⁰⁸ The U.S. Navy's most recent cruiser was procured in FY1988 and entered service in 1994, and the Navy's 30-year shipbuilding plan includes no ships identified as cruisers. The three Zumwalt (DDG-1000) class destroyers currently being built for the U.S. Navy, however, will each displace more than 15,000 tons. The U.S. Navy's other cruisers and destroyers have displacements of 9,000 to 9,500 tons.

Figure 8. Renhai (Type 055) Cruiser (or Large Destroyer)



Source: Cropped version of photograph accompanying David Axe, “China’s Giant New Cruiser Matches America’s Naval Firepower,” *War Is Boring*, October 5, 2017, which states the following: “Chinese state television has broadcast the first clear, overhead view of the Chinese navy’s first Type 055 cruiser.”

The first Type 055 ship reportedly was launched (i.e., put into the water for the final stages of construction) on June 28, 2017.¹⁰⁹ *IHS Jane’s Fighting Ships 2017-2018* (which refers to the Type 055 design as a destroyer) states that the first Type 055 ship is expected to enter service in 2019, and the second and third ships in 2020.¹¹⁰ A November 3, 2017, press report states that “China has accelerated the deployment of its ace guided-missile destroyers, known as Type 055, as four of the latest-generation warships, capable of attacking targets onshore, offshore and underwater, are being built at the nation’s two largest shipyards in Shanghai and Dalian.”¹¹¹ A January 8, 2018, press report states that “modular assembly for the third and fourth Type 055s has been revved up and construction of the second batch of four extra modified sea bases has been scheduled for the [Jiangnan Shipyard in Shanghai] as well as the Dalian Shipyard.”¹¹² A March 15, 2018, press report stated that China had begun construction of the sixth Type 055 ship.¹¹³

¹⁰⁹ See, for example, Mike Yeo, “China Launches Its Most Advanced Homegrown Class of Guided-Missile Destroyers,” *Defense News*, June 28, 2017; Michael Martina, “China Launches New Class of Naval Destroyer,” *Reuters*, June 28, 2017; Brad Lendon, “China’s Newest Destroyer Seen As Challenge to Asia Rivals,” *CNN*, June 28, 2017; Jeffrey Lin and P. W. Singer, “China Launches Asia’s Biggest post-WWII Warship,” *Popular Science*, June 28, 2017; Tyler Rogoway, “China’s Type 055 Super Destroyer Is A Reality Check For The US And Its Allies,” *The Drive*, June 28, 2017; Ridzwan Rahmat, “China Launches Largest Surface Combatant to Date,” *Jane’s 360*, June 29, 2017; Liu Zhen, “Asia’s Biggest, Most Advanced Warship Finally Launches as China Strengthens Naval Presence,” *South China Morning Post*, June 28, 2017; Zhao Lei, “Destroyer Called One of World’s Mightiest,” *China Daily*, June 29, 2017; James Goldrick, “China’s New Warship and the Strategic Challenge to America,” *Lowy Institute Interpreter*, July 4, 2017.

¹¹⁰ *IHS Jane’s Fighting Ships 2017-2018*, p. 147.

¹¹¹ Asia Times Staff, “More Details of PLA’s Ace Type 055 Destroyer Unveiled,” *Asia Times*, November 3, 2017.

¹¹² Asia Times staff, “Powerful Destroyers to Protect China’s Aircraft Carriers,” *Asia Times*, January 8, 2018.

¹¹³ Sean O’Connor, “China Begins Work on Sixth Type 055 Destroyer,” *Jane’s Defence Weekly*, March 14, 2018; see also Franz-Stefan Gady, “China Kicks off Work on 6th Type 055 Guided-Missile Destroyer,” *The Diplomat*, March 15, 2018.

Sovremenny-Class Destroyers

China in 1996 ordered two Sovremenny-class destroyers from Russia; the ships entered service in 1999 and 2001. China in 2002 ordered two additional Sovremenny-class destroyers from Russia; the ships entered service in 2005 and 2006. Sovremenny-class destroyers displace about 8,100 tons and are equipped with the Russian-made SS-N-22 Sunburn ASCM, a highly capable ASCM.

Six New Indigenously Built Destroyer Classes

China since the early 1990s has put into service six new classes of indigenously built destroyers, including three variations of one class. The classes are called the Luhu (Type 052A), Luhai (Type 051B), Louzhou (Type 051C), Luyang I (Type 052B), Luyang II (Type 052C), and Luyang III (Type 052D) designs.

Figure 9. Luyang II (Type 052C) Class Destroyer



Source: Photograph provided to CRS by Navy Office of Legislative Affairs, December 2010.

Compared to China's remaining older Luda (Type 051) class destroyers, which entered service between 1971 and 1991, these six new indigenously built destroyer classes are substantially more modern in terms of their hull designs, propulsion systems, sensors, weapons, and electronics.

The Luyang II-class ships (**Figure 9**) and the Luyang III-class ships, which displace about 7,100 tons and 7,500 tons, respectively, appear to feature phased-array radars that are outwardly somewhat similar to the SPY-1 radar used in the U.S.-made Aegis combat system. Like the older Luda-class destroyers, these six new destroyer classes are armed with ASCMs.

As shown in **Table 2**, China between 1994 and 2007 commissioned only one or two ships in its first four new indigenously built destroyers classes, suggesting that these classes were intended as

stepping stones in a plan to modernize the PLA Navy’s destroyer technology incrementally before committing to larger-scale series production of Luyang II- and Luyang III-class destroyers.

Table 2. PLA Navy Destroyer Commissionings

Actual (1994-2016) and Projected (2017-2019)

	Sovre- menny (Russian- made)	Luhu (Type 052A)	Luhai (Type 051B)	Luyang I (Type 052B)	Lyugang II (Type 052C)	Louzhou (Type 051C)	Luyang III (Type 052D)	Annual total	Cumulative total
1994		1						1	1
1995								0	1
1996		1						1	2
1997								0	2
1998								0	2
1999	1		1					2	4
2000	1							1	5
2001								0	5
2002								0	5
2003								0	5
2004				2	1			3	8
2005	1				1			2	10
2006	1					1		2	12
2007						1		1	13
2008								0	13
2009								0	13
2010								0	13
2011								0	13
2012								0	13
2013					2			2	15
2014					1		1	2	17
2015					1		2	3	20
2016							1	1	21
2017							5	5	26
2018							3	3	29
2019							1	1	30

Source: IHS Jane’s *Fighting Ships 2017-2018*, and previous editions.

As also shown in **Table 2**, after commissioning no new destroyers in 2008-2012—a hiatus that may have been caused in part by the relocation of a shipyard¹¹⁴—commissionings of new Luyang

¹¹⁴ Regarding the 2008-2012 gap in commissionings, one observer states, “The relocation of JiangNan shipyard and indigenization of [the] DA80/DN80 gas turbine (QC-280) delayed the production of follow-on units [of Luyang II-class destroyers] for several years.” (Blog entry entitled “2012 in Review,” December 28, 2012, accessed March 21, 2013, at <http://www.informationdissemination.net/2012/12/2012-in-review.html>.)

II- and Luyang III-class destroyers resumed. *IHS Jane's Fighting Ships 2017-2018* states that a class of at least 10 ships is expected.¹¹⁵

Four New Indigenously Built Frigate Classes

China since the early 1990s has put into service four new classes of indigenously built frigates, two of which are variations of two others. The classes are called the Jiangwei I (Type 053 H2G), Jiangwei II (Type 053H3), Jiangkai I (Type 054), and Jiangkai II (Type 054A) designs. **Figure 10** shows a Jiangkai II-class ship.

Figure 10. Jiangkai II (Type 054A) Class Frigate



Source: Photograph provided to CRS by Navy Office of Legislative Affairs, December 2010.

Compared with China's remaining older Jianghu (Type 053) class frigates, which entered service between the mid-1970s and 1989, the four new frigate classes feature improved hull designs and systems, including improved AAW capabilities. DOD states that "China continues to produce the JIANGKAI II-class guided-missile frigate (FFG) (Type 054A), with more than 20 ships currently in the fleet and several more in various stages of construction."¹¹⁶ A December 25, 2016, blog post states that "the production run for [the] Type 054A appears to be coming to a close. Only 2 Type 054As joined service earlier this year with 2 more ready to join service soon."¹¹⁷ The 26th Type 054A reportedly was commissioned into service on January 12, 2018.¹¹⁸ The 29th Type 054A

¹¹⁵ *IHS Jane's Fighting Ships 2017-2018*, p. 144.

¹¹⁶ *2017 DOD CMSD*, p. 25.

¹¹⁷ Feng, "Notable Things from 2016," *China Air and Naval Power*, December 25, 2016.

¹¹⁸ Gabriel Dominguez, "PLAN Inducts Type 054A Frigate Into North Sea Fleet," *Jane's Defence Weekly*, January 15, 2018; Franz-Stefan Gady, "China Inducts 26th Type 054A Guided-Missile Stealth Frigate Into Service," *The Diplomat*, January 16, 2018.

reportedly was launched (i.e., put into the water for the final stages of construction) on December 16, 2017.¹¹⁹ **Table 3** shows commissionings of new frigates since 1991.

Table 3. PLA Navy Frigate Commissionings

Actual (1991-2016) and Projected (2017-2018)

	Jiangwei I (Type 053 H2G)	Jiangwei II (Type 053H3)	Jiangkai I (Type 054)	Jiangkai II (Type 054A)	Annual total	Cumulative total
1991	1				1	1
1992	1				1	2
1993	1				1	3
1994	1				1	4
1995					0	4
1996					0	4
1997					0	4
1998		1			1	5
1999		4			4	9
2000		1			1	10
2001					0	10
2002		2			2	12
2003					0	12
2004		1			1	13
2005		1	1		2	15
2006			1		1	16
2007					0	16
2008				4	4	20
2009					0	20
2010				3	3	23
2011				2	2	25
2012				4	4	29
2013				3	3	32
2014					0	32
2015				3	3	35
2016				4	4	39
2017				2	2	41
2018				2 ^a	2	43

Source: IHS Jane's Fighting Ships 2017-2018, and previous editions.

a. IHS Jane's Fighting Ships 2017-2018 states that a total of 30 Jiangkai II-class ships is expected.

Jiangdao (Type 056) Corvette

China is building a new type of corvette (i.e., a light frigate, or FFL) called the Jiangdao class or Type 056/056A (**Figure 11**). Jiangdao-class ships are reportedly being built at a high annual rate in four shipyards.¹²⁰ IHS Jane's Fighting Ships 2017-2018 states that the first 8 ships were

¹¹⁹ Franz-Stefan Gady, "China Launches New Type 054A Guided-Missile Stealth Frigate," *The Diplomat*, December 20, 2018.

¹²⁰ Feng, "Notable Things from 2016," *China Air and Naval Power*, December 25, 2016.

commissioned into service in 2013, followed by 10 more in 2014, 5 more in 2015, 7 more in 2016, and 11 more projected for 2017, for a projected total of 41 through 2017, and that “a large class (possibly 60 ships) is expected if the class is to consolidate replacement of older classes such as the Jianghu-class frigates and Houxin-class attack craft.”¹²¹ A November 30, 2017, blog post states that a total of 37 were in operation as of that date, and that a total of 60 might eventually be built.¹²² DOD states that

The PLAN is augmenting its littoral warfare capabilities, especially in the South China Sea and East China Sea, with the production of the JIANGDAO-class corvettes (FFL) (Type 056). More than 25 were in service during 2016. The latest ships are anti-submarine warfare (ASW) variants with a towed-array sonar. China may build more than 60 of this class, ultimately replacing older PLAN destroyers and frigates.¹²³

Figure 11. Jingdao Type 056 Corvette

Shown under construction



Source: Photo captioned “The CNS Ningde, a Type-056 class corvette, sails in waters off Dalian, Liaoning province, in November. Provided To China Daily,” published as part of Zhao Lei, “New Vessel Beefs Up PLA Navy Fleet,” *China Daily*, January 21, 2017.

ONI states that

In 2012, China began producing the new JIANGDAO-class (Type 056) corvette (FFL), which offers precisely the flexibility that the HOUBEI lacks. The JIANGDAO is equipped to patrol China’s claimed EEZ and assert Beijing’s interests in the South China and East China Seas. The 1500-ton JIANGDAO is equipped with 76mm, 30mm, and

¹²¹ *IHS Jane’s Fighting Ships 2017-2018*, p. 153.

¹²² Franz-Stefan Gady, “China’s Navy Inducts 2 More Sub Killer Stealth Warships,” *The Diplomat*, November 30, 2017.

¹²³ *2017 DOD CMSD*, p. 25.

12.7mm guns, four YJ-83 family ASCMs, torpedo tubes, and a helicopter landing area. The JIANGDAO is ideally-suited for general medium-endurance patrols, counterpiracy missions, and other littoral duties in regional waters, but is not sufficiently armed or equipped for major combat operations in blue-water areas. At least 20 JIANGDAOs are already operational and 30 to 60 total units may be built, replacing both older small patrol craft as well as some of the PLA(N)'s aging JIANGHU I-class (Type 053H) frigates (FF).¹²⁴

Houbei (Type 022) Fast Attack Craft

As a replacement for at least some of its older fast attack craft, or FACs (including some armed with ASCMs), China in 2004 introduced a new type of ASCM-armed fast attack craft, called the Houbei (Type 022) class (**Figure 12**), that uses a stealthy, wave-piercing, catamaran hull.¹²⁵ Each boat can carry eight C-802 ASCMs. The Houbei class was built in at least six shipyards; construction of the design appeared to stop in 2009 after a production run of about 60 units.

Figure 12. Houbei (Type 022) Class Fast Attack Craft

With an older Luda-class destroyer behind



Source: Photograph provided to CRS by Navy Office of Legislative Affairs, December 2010.

ONI states the following:

During the past two decades, China phased out hundreds of Cold War-era OSA and HOUKU-class missile patrol boats and gun-armed SHANGHAI and HAINAN-class patrol craft (among others) as the PLA(N) transitioned from coastal defense missions towards offshore and far seas operations. However, China retains a modern coastal-defense and area-denial capability with 60 HOUBEI (Type 022) class missile patrol craft (PTG) built in the mid-2000s to supplement 25 1990s-vintage HOUJIAN and HOUXIN-class missile patrol combatants. The HOUBEI design integrates a high-speed wave-piercing catamaran hull, waterjet propulsion, signature-reduction features, and the YJ-83

¹²⁴ 2015 ONI Report, p. 17.

¹²⁵ For an article discussing how the Type 022 design appears to have been derived from the designs of Australian high-speed ferries, see David Lague, "Insight: From a Ferry, a Chinese Fast-Attack Boat," *Reuters*, June 1, 2012.

family ASCM. Although poorly equipped for offshore patrol duties, the HOUBEI is valuable for reacting to specific threats in China's exclusive economic zone (EEZ) and slightly beyond.¹²⁶

As noted in the previous section, these ships eventually may be replaced by Type 056 corvettes.

Coast Guard Cutters

China in 2013 consolidated four of its five maritime law enforcement (MLE) agencies into a new China Coast Guard (CCG). China usually uses CCG ships, rather than PLAN ships, to assert and defend its maritime territorial claims and fishing interests in the South China Sea and East China Sea, although PLAN ships are available as backup forces. While China's CCG ships are often unarmed or lightly armed, they can nevertheless be effective in confrontations with unarmed fishing vessels or other ships. **Figure 13** shows a picture of a CCG ship.

Figure 13. China Coast Guard Ship



Source: Picture accompanying Jeff. W. Benson, "Clash for Naval Power in the Asia Pacific," *USNI News* (<http://news.usni.org>), November 25, 2013, accessed May 23, 2014.

China is rapidly modernizing its inventory of CCG ships, and some of China's newest CCG ships are relatively large.¹²⁷ DOD states that

The CCG is responsible for a wide range of missions, including enforcement of China's sovereignty claims, anti-smuggling, surveillance, protection of fisheries resources, and general law enforcement. China primarily uses civilian maritime law enforcement

¹²⁶ 2015 ONI Report, p. 17.

¹²⁷ See, for example, Ryan Martinson, "Power to the Provinces: The Devolution of China's Maritime Rights Protection," *China Brief* (<http://www.jamestown.org/programs/chinabrief>), September 10, 2014.

agencies in maritime disputes, and employs the PLAN in an overwatch capacity in case of escalation.

The enlargement and modernization of the CCG forces has improved China's ability to enforce its maritime claims. The CCG is increasing its total force level at a rapid pace. Since 2010, the CCG's large patrol ship fleet (more than 1,000 tons) has more than doubled in size from approximately 60 to more than 130 ships, making it by far the largest coast guard force in the world and increasing its capacity to conduct extended offshore operations in a number of disputed areas simultaneously. Furthermore, the newer ships are substantially larger and more capable than the older ships, and the majority are equipped with helicopter facilities, high-capacity water cannons, and guns ranging from 30mm to 76mm. Among these ships, a number are capable of long-distance, long-endurance out-of-area operations.

In addition, the CCG operates more than 70 fast patrol combatants (more than 500 tons), which can be used for limited offshore operations, and more than 400 coastal patrol craft (as well as approximately 1000 inshore and riverine patrol boats). By the end of the decade, the CCG is expected to add another 25-30 patrol ships and patrol combatants before the construction program levels off.¹²⁸

ONI states that

During the last decade, China's MLE force has undergone a major modernization, which increased both the sizes of its ships and their overall capability. These civilian maritime forces have added approximately 100 new large patrol ships (WPS), patrol combatants/craft (WPG/WPC), and auxiliary/support ships, not including small harbor and riverine patrol boats.

The current phase of the construction program, which began in 2012, will add over 30 large patrol ships and over 20 patrol combatants to the force by 2015. This will increase by 25 percent the overall CCG force level in a fleet that is also improving rapidly in quality. Most MLE ships are either unarmed or armed only with light deck weapons (12.7mm, 14.5mm, and 30mm guns) and generally use commercial radars and communications equipment. Several of the largest ships are equipped with helicopter landing and hangar facilities as well.¹²⁹

Amphibious Ships and Aircraft, and Potential Floating Sea Bases

Overview

DOD states that

The PLA continues to make modest gains in amphibious warfare by integrating new capabilities and training consistently. Its amphibious warfare capability focuses on two geographic areas: the PLAA [PLA Army] focuses its amphibious efforts on a Taiwan invasion while the PLAN Marine Corps (PLANMC) focuses on small island seizures in the South China Sea, with a potential emerging mission in the Senkakus. Both the PLAA and the PLANMC continue to integrate closely with the PLAN's amphibious forces and the PLAA's Maritime Transport Squadron.

¹²⁸ 2017 DOD CMSD, p. 56.

¹²⁹ 2015 ONI Report, p. 46. See also Jane Perlez, "China Is Rapidly Adding Coast Guard Ships, U.S. Navy Says," *New York Times*, April 10, 2015; Ryan D. Martinson, "China's Second Navy," *U.S. Naval Institute Proceedings*, April 2015: 24-29; Ryan D. Martinson, "East Asian Security in the Age of the Chinese Mega-Cutter," Center for International Maritime Security (CIMSEC), July 3, 2015.

In 2016, amphibious elements of the PLAA's 1st Group Army and 31st Group Army continued to improve their ability to conduct and sustain amphibious operations. The 1st Group Army's training in the newly formed Eastern Theater featured new components, including real-time ISR, precision targeting for close air support assets, and nighttime reconnaissance and attack training. The 31st Group Army's training in the Southern Theater demonstrated a combined ground warfare concept in which amphibious and ground forces used an integrated command information system to coordinate a multi-pronged assault. This exercise included armor, infantry, and artillery units from both regular army and amphibious units, integrated with army aviation, chemical defense, and special warfare units.

The two PLANMC brigades conducted battalion-level amphibious training at their respective training areas in Guangdong (Southern Theater). The training focused on swimming amphibious armored vehicles from sea to shore, small boat assault, and deployment of special forces by helicopter. The PLANMC also participated in two bilateral exercises, one with Russia and one with Thailand; however, these exercises do not appear to have been very advanced.

The PLAN added the fourth YUZHAO-class LPD to its amphibious fleet in 2016, along with three new LSTs. Both classes are integrated into PLAA and PLANMC routine amphibious training.¹³⁰

DOD also states that

Large-scale amphibious invasion is one of the most complicated and difficult military operations. Success depends upon air and sea superiority, the rapid buildup and sustainment of supplies onshore, and uninterrupted support. An attempt to invade Taiwan would strain China's armed forces and invite international intervention. These stresses, combined with China's combat force attrition and the complexity of urban warfare and counterinsurgency (assuming a successful landing and breakout), make an amphibious invasion of Taiwan a significant political and military risk. Taiwan's investments to harden infrastructure and strengthen defensive capabilities could also decrease China's ability to achieve its objectives.

The PLA is capable of accomplishing various amphibious operations short of a full-scale invasion of Taiwan. With few overt military preparations beyond routine training, China could launch an invasion of small Taiwan-held islands in the South China Sea such as Pratas or Itu Aba. A PLA invasion of a medium-sized, better-defended island such as Matsu or Jinmen is within China's capabilities. Such an invasion would demonstrate military capability and political resolve while achieving tangible territorial gain and simultaneously showing some measure of restraint. However, this kind of operation involves significant, and possibly prohibitive, political risk because it could galvanize pro-independence sentiment on Taiwan and generate international opposition.¹³¹

Yuzhao (Type 071) Amphibious Ship

China has put into service a new class of amphibious ships called the *Yuzhao* or Type 071 class (**Figure 14**). The Type 071 design has an estimated displacement of more than 19,855 tons,¹³² compared with about 15,900 tons to 16,700 tons for the U.S. Navy's Whidbey Island/Harpers

¹³⁰ 2017 DOD CMSD, p. 83.

¹³¹ 2017 DOD CMSD, p. 77.

¹³² 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.

Ferry (LSD-41/49) class amphibious ships, which were commissioned into service between 1985 and 1998, and about 25,900 tons for the U.S. Navy's new San Antonio (LPD-17) class amphibious ships, the first of which was commissioned into service in 2006.

Figure 14. Yuzhao (Type 071) Class Amphibious Ship

With two Houbei (Type 022) fast attack craft behind



Source: Photograph provided to CRS by Navy Office of Legislative Affairs, December 2010.

IHS Jane's Fighting Ships 2017-2018 states that the first four ships in the class were commissioned into service in 2007, 2011, 2012, and 2016, and that the fifth and sixth ships in the class are expected enter service in 2018 and 2019.¹³³ A December 5, 2017, blog post shows a photo of what the post described as the sixth ship in the class under construction.¹³⁴ DOD states that

The PLAN has four large YUZHAO-class (Type 071) amphibious transport docks (LPD). The YUZHAO LPD provides a greater and more flexible capability for “far seas” operations than the PLAN’s older landing ships. It can carry up to four of the new YUYI-class air-cushion medium landing craft and four or more helicopters, as well as armored vehicles and PLAN Marines for long-distance deployments.¹³⁵

Reported Construction of Type 075 Amphibious Assault Ship

Observers for the past few years have been expecting China to begin building a class of LHD-type amphibious assault ships that would be larger than the Type 071 design. The expected new class was earlier referred to as the Type 081 design, but is more recently being referred to as the Type 075 design.

¹³³ *IHS Jane's Fighting Ships 2017-2018*, p. 160.

¹³⁴ “Photo of the Day: The 6th Type071 LPD Fitting Out in Shanghai,” *China Defense Blog*, December 5, 2017.

¹³⁵ *2017 DIOD CMSD*, pp. 25-26.

DOD states that “the PLAN probably will continue YUZHAO [Type 071] LPD construction, even as it pursues a follow-on amphibious assault ship that is not only larger, but also incorporates a full flight deck for helicopters.”¹³⁶ A March 29, 2017, press report states that China has begun building an LHD-type amphibious assault ship. The press report included an unofficial artist’s rendering of the ship (**Figure 15**) stating that the ship would have a displacement of 40,000 tons. (By comparison, U.S. Navy LHD/LHA-type amphibious assault ships displace 41,000 tons to 45,000 tons.) *IHS Jane’s Fighting Ships 2017-2018* states the following:

It was reported in April 2017 that a new Type 075 Landing Helicopter Dock (LHD) ship is under construction at Hudong-Zhonghua Shipyard, Shanghai. The ship is reported to have a displacement on the order of 40,000 tonnes and a length of 245m[eters] [about 804 feet]. The ship is believed to be capable of operating of the order of 30 helicopters and to be equipped with a well-deck aft from which amphibious craft can be operated.¹³⁷

The March 29, 2017, press report stated the following:

China has started building a new generation of large amphibious assault vessels that will strengthen the navy as it plays a more dominant role in projecting the nation’s power overseas, military sources said.

The 075 Landing Helicopter Dock [LHD] is now under construction by a Shanghai-based shipbuilding company, the sources said.

The amphibious vessel is far larger than similar ships previously constructed for the PLA Navy.

The 075 can serve as a form of aircraft carrier and military experts said it would give China’s navy the ability to launch various types of helicopters to attack naval vessels, enemy ground forces or submarines in the East or South China Sea....

China’s navy commander, Vice-Admiral Shen Jinlong, visited the Hudong Zhonghua Shipbuilding Company on Sunday, which specialises in building Landing Helicopter Docks, the company said on its website.

One source close to the navy said Shen’s inspection trip confirmed construction work was underway on the new class of vessel.

“Construction of the Type 075 ships will take two more years,” the source said. “The first vessel may be launched as early as 2019 and put into full service in 2020.”...

The Macau-based military observer Antony Wong Dong said building the bigger Type 075 vessels, which are similar in size to the largest American Wasp-class amphibious ships, would help the navy match the US in the use of helicopters in its fleet.

“China has so many giant warships, including four Type 071 amphibious vessels and two aircraft carriers, but its vertical landing capability is still limited due to a lack of the largest helicopter dock vessels,” Wong said. “The launch of Type 075 will let the navy become the world’s No 2 powerful navy after the US.”

The Type 075 is able to deploy and house up to 30 armed helicopters. Six helicopters will be able to take off from the flight deck at the same time.

The vessels will also be able to deploy landing craft and troops, plus house command and control operations.¹³⁸

¹³⁶ 2017 DOD CMSD, p. 26.

¹³⁷ *IHS Jane’s Fighting Ships 2017-2018*, p. 158.

¹³⁸ Minnie Chan, “China Building Navy’s Biggest Amphibious Assault Vessel, Sources Say,” *South China Morning* (continued...)

Figure 15. Type 075 LHD
Unofficial artist's rendering

China's first helicopter ship



Type 075 amphibious assault

Specifications

Displacement:	40,000 tonnes
Length:	250m
Beam:	30m
Draft:	8m
Aircraft carried:	30 armed helicopters in hanger; four helicopter elevators on deck
Manufacturer:	Hudong Zhonghua Shipbuilding Company

Source: PLA, SCMP

SCMP

Source: Minnie Chan, "China Building Navy's Biggest Amphibious Assault Vessel, Sources Say," *South China Morning Post*, March 29, 2017.

Potential Roles for Type 071 and Type 075 Ships

Although larger amphibious ships such as the Type 071 and the expected 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 territorial claims in the East China Sea and South China Sea, humanitarian assistance and 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. DOD states that

(...continued)

Post, March 29, 2017.

“China’s investments in its amphibious ship force signal its intent to develop expeditionary amphibious assault, HA/DR, and counterpiracy capabilities.”¹³⁹

Landing Craft

In June 2013, it was reported that China in May 2013 had taken delivery of four large, Ukrainian-made Zubr-class air-cushioned landing craft (LCACs). The craft reportedly have a range of 300 nautical miles, a maximum speed of 63 knots, and a payload capacity of 150 tons. China in July 2014 used at least one of the craft in an amphibious assault exercise in the South China Sea.¹⁴⁰

In February 2017, it was reported that China has begun mass producing a new type of LCAC, called the Type 726, capable of carrying a Chinese tank and moving at speeds of more than 60 knots.¹⁴¹

Ship Similar to U.S. Navy’s Expeditionary Transfer Dock (ESD) Ship

In July 2015, it was reported that China’s navy had commissioned into service a ship similar to the U.S. military’s Expeditionary Transfer Dock (ESD) Ship (previously called the Mobile Landing Platform, or MLP, ship). China’s ship, like the U.S. ESD, is a semi-submersible ship that can support ship-to-shore movement of equipment by serving as a “pier at sea” for ships that lack a well deck for accommodating landing craft. China’s ESD-like ship, with an estimated displacement of about 20,000 tons, is smaller than the U.S. ESD.¹⁴²

Potential Use of Civilian Ships

Some observers have commented over the years on the possibility that China could use civilian ships to assist in an amphibious operation. In June 2015, it was reported that China had approved a plan to ensure that civilian ships can support maritime military operations in the event of a crisis.¹⁴³

AG-600 Amphibious Aircraft

China has developed a large new amphibious aircraft (aka seaplane—an aircraft that can take off from, and land back onto, the surface of the water) called the AG-600 (**Figure 16**). The four-engine aircraft, which was shown at a Chinese airshow in 2016, reportedly has a cruising speed of about 270 knots and a flying range of roughly 2,400 nautical miles to 2,800 nautical miles, and can carry 50 passengers or 12 tons of water when used for firefighting. The aircraft’s reported missions are civilian in nature, including primary missions of maritime search and rescue and firefighting, and potential additional missions such as observing and protecting the marine environment, resource exploration, resupplying reef outposts, protection against smuggling

¹³⁹ 2017 DOD CMSD, p. 25. See also 2015 ONI Report, p. 18, and 2015 Report to Congress of the U.S. China Economic and Security Review Commission, November 2015, pp. 243-244.

¹⁴⁰ Franz-Stefan Gady, “Beijing Practices Invasion of South China Sea islands,” *The Diplomat*, July 24, 2014. See also Jeffrey Lin and P.W. Singer, “China Practices Pacific D-Days With Tanks And Hovercraft,” *Popular Science*, July 27, 2015.

¹⁴¹ “Beijing Mass-Producing Amphibious Landing Craft,” *China Post*, February 4, 2017.

¹⁴² Mike Yeo, “China Commissions First MLP-Like Logistics Ship, Headed For South Sea Fleet,” *USNI News*, July 14, 2015; “China Gains Semi-Submersible Ship for South China Sea Fleet,” *Reuters*, July 10, 2015; Megha Rajagopalan, “This Submersible Cargo Ship Strengthens Beijing’s Hand in the South China Sea,” *Business Insider*, July 10, 2015.

¹⁴³ Franz-Stefan Gady, “China Prepares Its 172,000 Civilian Ships for War,” *The Diplomat*, June 23, 2015.

operations, and enforcing China's maritime claims. Some observers have speculated about the potential for using the aircraft for military missions. It is unclear whether the aircraft will be put into serial production, how many in total might be built, or for which Chinese government agencies.¹⁴⁴

Figure 16. AG-600 Amphibious Aircraft



Source: Photograph accompanying Charlie Moore, "It's A Sea Monster! China Unveils World's Largest Amphibious Aircraft Used to Fight Forest Fires and Perform Marine Rescues," *Daily Mail (UK)*, July 24, 2016.

Potential Floating Sea Bases

China reportedly is building or preparing to build one or more large floating sea bases. The bases (see **Figure 17**) are referred to in press reports as very large floating structures (VLFSs). They are broadly similar in appearance to a concept known as the Mobile Offshore Base (MOB) that U.S. defense planners considered at one point years ago. VLFSs could be used for supporting operations by aircraft and surface ships and craft.

An August 10, 2015, press report states the following:

China's military wants the ability to create large modular artificial islands that can be repositioned around the world as necessary. And it's not as outlandish a goal as it might seem.

According to Navy Recognition, China's Jidong Development Group unveiled its first design for a Chinese-built Very Large Floating Structure (VLFSs) at its National Defense Science and Technology Achievement exhibition in Beijing at the end of July. The structures are comprised of numerous smaller floating modules that can be assembled together at sea in order to create a larger floating platform.

¹⁴⁴ For discussions of the aircraft, see, for example, Lyle J. Goldstein, "What Is China Thinking with Its Newest Plane Design?" *National Interest*, September 18, 2017; Charlie Moore, "It's A Sea Monster! China Unveils World's Largest Amphibious Aircraft Used to Fight Forest Fires and Perform Marine Rescues," *Daily Mail (UK)*, July 24, 2016.

VLSFs have a number of uses. The artificial islands can be used as fake islands for touristic purposes, or can also be constructed to function as piers, military bases, or even floating airports, Navy Recognition notes.¹⁴⁵

Figure 17. Very Large Floating Structure (VLFS)

Notional Artist's Rendering



Source: Liang Jun, “China Displays Its First Large Floating Structure,” *People’s Daily Online*, July 30, 2015.

An August 19, 2015, press report states the following:

Two Chinese companies are to build 3.2-kilometer [2-mile] long platforms that could host airstrips, docks, helipads, barracks, or even “comprehensive security bases”, the *Financial Times* quoted Feng Jun, chairman of Hainan Offshore Industry as saying on August 18.

[The] *Financial Times* says Jidong Development Group have confirmed its contribution to most of the 3.7 billion yuan in research funding of the project. Hainan Offshore Industry will also play a part in the project.

Although the “Floating Fortresses” so far “are only in the design and research phase”, western media are already paying close attention on the project, which also drew criticism from military observers.

“Planting one of these in the middle of the South China Sea would be a terribly provocative act,” said Richard Bitzinger, a U.S. authority on maritime security.

However, experts incline to the view that these platforms are more likely to serve large oil drilling rigs. The two companies also emphasize on the peaceful application of the giant platforms, mentioning duty-free shopping malls and exotic tourist destinations.

The first VLFS (very large floating structure) of the project is currently under construction at dry dock in Caofeidian near Beijing.¹⁴⁶

¹⁴⁵ Jeremy Bender, “China Wants To Build Giant Floating Islands in the South China Sea,” *Business Insider*, August 10, 2015. The Navy Recognition article referred to is: “China Unveiled its First VLFS Project Similar to the US Military Mobile Offshore Base Concept,” *Navy Recognition*, August 9, 2015. See also Jeffrey Lin and P.W. Singer, “Chinese Shipyard Looks to Build Giant Floating Islands,” *Popular Science*, April 20, 2015.

¹⁴⁶ Luxioa Zou, “Two Chinese Companies to Build ‘Floating Fortresses,’” *People’s Daily Online*, August 19, 2015. See (continued...)

Unmanned Surface Vehicles (USVs)

A September 25, 2017, press report states that China is developing autonomous unmanned surface vehicles (USVs) for potential use by China's navy that could be equipped with sensors and weapons for tracking and attacking surface ships and submarines.¹⁴⁷ A February 3, 2018, press report stated that China had conducted its first test run of an SUV.¹⁴⁸

Land-Based Aircraft and Unmanned Aerial Vehicles (UAVs)

Land-Based Aircraft

ONI states that

During the past two decades, the PLANAF has made great strides in moving beyond its humble origins. Antiquated fixed-wing aircraft such as the Nanchang Q-5 Fantan and the Harbin H-5 Beagle have given way to an array of relatively high-quality aircraft. This force is equipped for a wide range of missions including offshore air defense, maritime strike, maritime patrol, antisubmarine warfare, and, in the not too distant future, carrier-based operations. Just a decade ago, this air modernization relied very heavily on Russian imports. Following in the footsteps of the People's Liberation Army Air Force (PLAAF), the PLA(N) has recently begun benefitting from domestic combat aircraft production.

Historically, the PLA(N) relied on older Chengdu J-7 variants and Shenyang J-8B/D Finback fighters for offshore air defense. These aircraft offered limited range, avionics, and armament. The J-8 is perhaps best known in the West as the aircraft that collided with a U.S. Navy EP-3 reconnaissance aircraft in 2001. The PLA(N)'s first major air capability upgrade came with the Su-30MK2 FLANKER. While the PLAAF had received numerous FLANKER variants from Russia between 1992 and 2002, the PLA(N) did not acquire its initial aircraft until very late in that process.

In 2002, China purchased 24 Su-30MK2, making it the first 4th-generation fighter aircraft fielded with the PLA(N). These aircraft feature both an extended range and maritime radar systems. This allows the Su-30MK2 to strike enemy ships at long distances, while maintaining a robust air-to-air capability. Several years later, the PLA(N) began replacing its older J-8B/D with the newer J-8F variant. The J-8F featured improved armament such as the PL-12 radar-guided air-to-air missile, upgraded avionics, and an improved engine with higher thrust. Today, the PLA(N) is taking deliveries of modern domestically produced 4th- generation fighter aircraft such as the J-10A Firebird and the J-11B FLANKER. Equipped with modern radars, glass cockpits, and armed with PL-8 and PL-12 air-to-air missiles, PLA(N) J-10A and J-11B are among the most modern aircraft in China's inventory.

For maritime strike, the PLA(N) has relied on the H-6 BADGER bomber for decades. The H-6 is a licensed copy of the ex-Soviet Tu-16 BADGER medium jet bomber, maritime versions of which can employ advanced ASCMs against surface targets. Despite the age of the design, the Chinese H-6 continues to receive electronics and

(...continued)

also Liang Jun, "China Displays Its First Large Floating Structure," *People's Daily Online*, July 30, 2015.

¹⁴⁷ Jeffrey Lin and P.W. Singer, "With the D3000, China Enters the Robotic Warship Arms Race," *Popular Science*, September 25, 2018. See also Tara Francis Chan, "China Wants to Start Testing Drone Ships in the South China Sea," *Business Insider*, February 12, 2018.

¹⁴⁸ Teddy Ng, "China Carries Out First Run of Unmanned Vessel As It Seeks to Boost Maritime Security," *South China Morning Post*, February 3, 2018. See also "Sea Sentinels: Chinese Unmanned Maritime Systems Gain traction," *Jane's*, 2018.

payload upgrades, which keep the aircraft viable. We think as many as 30 of these aircraft remain in service....

With at least five regiments fielded across the three fleets, the JH-7 FLOUNDER augments the H-6 for maritime strike. The JH-7 is a domestically produced tandem-seat fighter/bomber, developed as a replacement for obsolete Q-5 Fantan light attack aircraft and H-5 Beagle bombers....

In addition to combat aircraft, the PLA(N) is expanding its inventory of fixed-wing maritime patrol aircraft (MPA), airborne early warning (AEW), and surveillance aircraft. China has achieved significant new capabilities by modifying several existing airframes. The Y-8, a Chinese license-produced version of the ex-Soviet An-12 Cub, forms the basic airframe for several PLA(N) special mission variants. All of these aircraft play a key role in providing a clear picture of surface and air contacts in the maritime environment. As the PLA(N) pushes farther from the coast, long-range aircraft capable of extended on-station times to act as the eyes and ears of the fleet become increasingly important.

Internet photos from 2012 indicated the development of a Y-9 naval variant that is equipped with a MAD (magnetic anomaly detector) boom, typical of ASW aircraft. This Y-9 ASW variant features a large surface search radar mounted under the nose as well as multiple blade antennae on the fuselage for probable electronic surveillance.¹⁴⁹

DOD states that

China also continues to upgrade its older H-6 bomber fleet to increase operational effectiveness by integrating standoff weapons. The H-6K is a redesign of an older model with turbofan engines to extend range and the capability to carry six land-attack cruise missiles (LACM), giving the PLA a long-range standoff precision strike capability that can reach Guam. PLAN Aviation fields the H-6G, with systems and four weapons pylons for ASCMs to support maritime missions.¹⁵⁰

UAVs

China reportedly is developing and fielding a range of UAV designs. DOD states that

the acquisition and development of longer-range unmanned aerial vehicles (UAVs) will increase China's ability to conduct long-range ISR and strike operations. In 2015, media reported the development of the Shendiao (Sacred Eagle or Divine Eagle) as the PLA's newest high-altitude, long-endurance UAV for a variety of missions such as early warning, targeting, EW, and satellite communications. Also in 2015, the PLAAF used a Yilong UAV (also known as the Wing Loong or Pterodactyl) to assist in HA/DR in the aftermath of an earthquake in China's west—the first public acknowledgment of PLAAF UAV operations.¹⁵¹

ONI states that

The PLA(N) will probably emerge as one of China's most prolific UAV users, employing UAVs to supplement manned ISR aircraft as well as to aid targeting for land-, ship-, and other air-launched weapons systems.... In addition to land-based systems, the PLA(N) is also pursuing ship-based UAVs as a supplement to manned helicopters.¹⁵²

¹⁴⁹ 2015 ONI Report, pp. 21-22.

¹⁵⁰ 2017 DOD CMSD, p. 28.

¹⁵¹ 2017 DOD CMSD, p. 52.

¹⁵² 2015 ONI Report, pp. 22-23. See also Brandon Hughes, "Chinese UAV Development and Implications for Joint (continued...)"

In an interview published in an October 15, 2017, blog post, one observer states the following:

Chinese military objectives primarily include the projection of sovereign power close to the landmass of China, recovering its ability to control or manage its sovereign sea space along Chinese borders, control of the South China Sea, and project power throughout Asia—though not necessarily project power globally. That is their military doctrine.

It has been very clear over the last several years that the Chinese are considering the use of drones, and incorporating them into doctrine as part of the asymmetric approach of closing the gap between themselves and the United States. Drones provide an asymmetric capability that is going to give the Chinese the ability to perform a number of both lethal and nonlethal roles with these platforms.

The U.S. is completely dependent on large and major weapons systems, whereas the Chinese are pursuing some major weapons systems development, but are really focusing on mass platforms—the term of art is “swarms.” They are not spending as much money and effort on the larger autonomous or remotely operated vehicle platforms. Instead, they are looking at a deeply historic Chinese military ethos and philosophy that says a well structured, yet conventionally inferior adversary can still defeat a superior adversary—the United States....

This is where the swarming aspect comes into play. Should a U.S. warship all of sudden get swarmed by hundreds if not a thousand small unarmed drones, it could have disruptive and distracting effects—impacting electronics and target acquisition for U.S. weapons systems by blinding them. There an infinite number of roles swarms of nonlethal drones could play.

By having the nonlethal drone military capability, it also gives the Chinese a non-kinetic way to conduct military operations in the prosecution of the sovereign Chinese seas—expedite control of a disputed island or interdict maritime traffic to control the waters. This allows them to project tactical military power that doesn’t cross that threshold into armed conflict—another dimension of Chinese military doctrine.¹⁵³

As noted earlier, press reports dated April 3 and 4, 2018, stated that China is developing carrier based UAVs.¹⁵⁴

Electromagnetic Railgun

Press reports in March 2018 stated that China is developing an electromagnetic railgun, and has installed what observers speculate may be a prototype version of such a weapon on a Chinese amphibious ship.¹⁵⁵ The U.S. Navy is developing a ship-based electromagnetic railgun for

(...continued)

Operations,” Center for International Maritime Security (CIMSEC), August 22, 2017.

¹⁵³ Doug Wise, “Chinese Drone ‘Swarms’ Could Overwhelm U.S. at Sea,” *Cipher Brief*, October 15, 2017 (interview with Doug Wise).

¹⁵⁴ Yang Sheng, “Government Support Needed for Carrier-Based UAVs ‘To Build Powerful Navy,’” *Global Times*, April 3, 2018; Asia Times staff, “Carrier-Based Attack Drones to Enter Service with LPA Navy,” April 4, 2018.

¹⁵⁵ “Reports Reveal Sea Tests of Electromagnetic Railguns,” *People’s Daily Online*, March 16, 2018; Tom O’Connor, “China Says It Is Testing World’s First Railgun at Sea, Confirming Leaked Photos of Electromagnetic weapon,” *Newsweek*, March 14, 2018; Yang Sheng, “Reports Reveal Major Achievements in Chinese Naval Weaponry,” *Global Times*, March 12, 2018. See also Melodie Ha, “Does China’s Navy Really Have a Railgun? (Or Is It a Hoax?),” *National Interest*, April 5, 2018.

potential use in missions such as naval surface fire support, air defense, and ballistic missile defense.¹⁵⁶

Nuclear and Electromagnetic Pulse (EMP) Weapons

A July 22, 2011, press report states that “China’s military is developing electromagnetic pulse weapons that Beijing plans to use against U.S. aircraft carriers in any future conflict over Taiwan, according to an intelligence report made public on Thursday [July 21].... The report, produced in 2005 and once labeled ‘secret,’ stated that Chinese military writings have discussed building low-yield EMP warheads, but ‘it is not known whether [the Chinese] have actually done so.’”¹⁵⁷

Maritime Surveillance and Targeting Systems

China reportedly is developing and deploying maritime surveillance and targeting systems that can detect U.S. ships and submarines and provide targeting information for Chinese ASBMs, ASCMs, and other Chinese military units. These systems reportedly include land-based over-the-horizon backscatter (OTH-B) radars, land-based over-the-horizon surface wave (OTH-SW) radars, electro-optical satellites, radar satellites, UAVs, and seabed sonar networks.¹⁵⁸ DOD states that

The PLAN also is improving its over-the-horizon (OTH) targeting capability with sky wave and surface wave OTH radars, which can be used in conjunction with reconnaissance satellites to locate targets at great distances from China, thereby supporting long-range precision strikes, including employment of ASBMs.¹⁵⁹

DOD also states that

The PLAN recognizes that long-range ASCMs require a robust, over-the-horizon targeting capability to realize their full potential, and China is investing in reconnaissance, surveillance, command, control, and communications systems at the strategic, operational, and tactical levels to provide high-fidelity targeting information to surface and subsurface launch platforms.¹⁶⁰

ONI states that

China is developing a wide array of sensors to sort through this complex environment and contribute to its maritime picture. The most direct method is reporting from the ships and aircraft that China operates at sea. These provide the most detailed and reliable

¹⁵⁶ For more on U.S. Navy efforts to develop a ship-based electromagnetic railgun, see CRS Report R44175, *Navy Lasers, Railgun, and Hypervelocity Projectile: Background and Issues for Congress*, by (name redacted) .

¹⁵⁷ Bill Gertz, “Beijing Develops Pulse Weapons,” *Washington Times*, July 22, 2011: 1. Except for “[July 21],” materials in brackets as in original.

¹⁵⁸ See *2011 DOD CMSD*, pp. 3 and 38; Lyle J. Goldstein, “China’s New Surveillance Technology May Expose U.S. Warships,” *National Interest*, November 7, 2017; Ben Blanchard, “China Ramps Up Military Use of Space With New Satellites – Report,” *Reuters*, July 11, 2011; Andrew Erickson, “Satellites Support Growing PLA Maritime Monitoring and Targeting Capabilities,” *China Brief*, February 10, 2011: 13-18; Torbjorg Hemmingsen, “Enter the Dragon: Inside China’s New Model Navy,” *Jane’s Navy International*, May 2011: 14-16, 18, 20, 22, particularly the section on target tracking on pages 15-16; Simon Rabinovitch, “China’s Satellites Cast Shadow Over US Pacific Operations,” *Financial Times*, July 12, 2011; Andrew S. Erickson, “Eyes in the Sky,” *U.S. Naval Institute Proceedings*, April 2010: 36-41.

¹⁵⁹ *2017 DOD CMSD*, p. 57. See also Shane Bilsborough, “China’s Emerging C4ISR Revolution,” *The Diplomat* (<http://thediplomat.com>), August 13, 2013; Andrew Tate, “China Launches Latest of Military, ‘Experimental’ Satellites,” *Jane’s Defence Weekly* (<http://www.janes.com>), September 28, 2014; William Lowther, “Chinese Spy Satellites ‘Might Threaten Navy,’” *Taipei Times* (www.taipeitimes.com), October 2, 2014.

¹⁶⁰ *2017 DOD CMSD*, p. 25.

information, but can only cover a fraction of the needed space. A number of ground-based coastal radars provide overlapping coverage of the area immediately off the coast, but their range is similarly limited.

To gain a broader view of the activity in its near and far seas, China has turned to more sophisticated sensors. The skywave OTH radar provides awareness of a much larger area than conventional radars by bouncing signals off the ionosphere. At the same time, China operates a growing array of reconnaissance satellites, which allow it to observe maritime activity anywhere on the earth. Two civilian systems also contribute to China's maritime awareness. The first is a coastal monitoring network for the Automatic Identification System (AIS)—an automated system required on most commercial vessels by the International Maritime Organization. China's Beidou system, installed on several thousand of its fishing boats, provides GPS-like navigation to the boats as well as automatic position reporting back to a ground station in China, allowing the location of the fishing fleet to be constantly monitored by fishing enforcement authorities.¹⁶¹

Naval Cyber Warfare Capabilities

ONI states that

Strategic Chinese military writings do not specifically deal with how China would employ cyber operations in a maritime environment, although they do make clear the importance of cyber operations. The PLA highlights network warfare as one of the “basic modes of sea battle” alongside air, surface, and underwater long-range precision strikes.” As the PLA's larger military investment in emerging domains such as cyber matures, the application of cyber operations in the maritime realm will consequently bolster the PLA(N)'s capability.¹⁶²

Quantum Technology Capabilities

A November 29, 2017, press report states the following:

The China Shipbuilding Industry Corporation (CSIC) and the University of Science and Technology of China (USTC) have signed a landmark agreement to collaborate on quantum technologies supporting the development of advanced naval mission systems.

Under the joint programme, the two parties will establish three laboratories in Wuhan, central China, which will be focused on developing quantum navigation, quantum communications, and quantum detection respectively.

Citing CSIC, the government's State Administration for Science, Technology and Industry for National Defense (SASTIND) said on 28 November that the project will be funded by the state-owned shipbuilder and represents “a significant move to increase investment and promote industrialisation in forward-looking and disruptive technologies”.¹⁶³

¹⁶¹ 2015 ONI Report, p. 25. See also Andrew Tate, “China Expands Short-Range Maritime ISR Capabilities,” *Jane's Intelligence Review*, December 29, 2017.

¹⁶² 2015 ONI Report, p. 24.

¹⁶³ Jon Grevatt, “China Looks to Quantum Technologies to Boost Naval Programmes,” *Jane's* 360, November 29, 2017. See also Raymond Wong, “Quantum Communications and Chinese SSBN Strategy,” *The Diplomat*, November 4, 2017.

Reported Potential Future Developments

Regarding potential future developments for China's navy, an October 24, 2017, blog post states the following:

Potential modernization plans or ambitions of the People's Liberation Army Navy (PLAN) were revealed in unprecedented detail by a former PLAN Rear Admiral in a university lecture, perhaps within the last 2-3 years. The Admiral, retired Rear Admiral Zhao Dengping, revealed key programs such as: a new medium-size nuclear attack submarine; a small nuclear auxiliary engine for conventional submarines; ship-based use of anti-ship ballistic missiles (ASBMs); next-generation destroyer capabilities; and goals for PLAN Air Force modernization. Collections of PowerPoint slides from Zhao's lecture appeared on multiple Chinese military issue webpages on 21 and 22 August 2017, apparently from a Northwestern Polytechnical University lecture. Notably, Zhao is a former Director of the Equipment Department of the PLAN. One online biography notes Zhao is currently a Deputy Minister of the General Armaments Department of the Science and Technology Commission and Chairman of the Navy Informatization Committee, so he likely remains involved in Navy modernization programs.

However, Zhao's precise lecture remarks were not revealed on these webpages. Also unknown is the exact date of Zhao's lecture, though it likely took place within the last 2-3 years based on the estimated age of some of his illustrations. His slides mentioned known PLAN programs like the Type 055 destroyer (DDG), a Landing Helicopter Dock (LHD) amphibious assault ship (for which he provided added confirmation), the Type 056 corvette, and the YJ-12 supersonic anti-ship missile.

Most crucially, it is Zhao's mention of potential PLAN programs that constitutes an unprecedented revelation from a PLAN source....

While there is also a possibility of this being a deception exercise, this must be balanced by the fact that additional slides were revealed on some of the same Chinese web pages on 23 September. The failure of Chinese web censors to remove both the earlier and later slides may also mean their revelation may be a psychological operation to intimidate future maritime opponents....

Admiral Zhao described a new unidentified 7,000-ton nuclear-powered attack submarine (SSN) that will feature a "new type of powerplant...new weapon system [and] electronic information system." An image shows this SSN featuring a sound isolation raft and propulsor which should reduce its acoustic signature, 12 cruise missile tubes in front of the sail, and a bow and sail similar to the current Type 093 SSN....

Zhao also revealed the PLAN may be working on a novel low power/low pressure auxiliary nuclear powerplant for electricity generation for fitting into conventional submarine designs, possibly succeeding the PLAN's current Stirling engine-based air independent propulsion (AIP) systems....

Zhao's slides detailed weapon and technical ambitions for future surface combatant ships. While one slide depicts a ship-launched ASBM flight profile, another slide indicates that future ships could be armed with a "near-space hypersonic anti-ship ballistic missile," perhaps meaning a maneuverable hypersonic glide vehicle (HGV) warhead already tested by the PLA, and a "shipborne high-speed ballistic anti-ship missile," perhaps similar to the land-based 1,500km range DF-21D or 4,000km range DF-26 ASBMs....

Another slide details that surface ships could be armed with "long-range guided projectiles," perhaps precision guided conventional artillery, a "shipborne laser weapon" and "shipborne directed-energy weapon."...

A subsequent slide details that a future DDG may have an "integrated electric power system," have "full-spectrum stealthiness," use an "integrated mast and integrated RF

technology, plus “new type laser/kinetic energy weapons,” and a “mid-course interception capability.” These requirements, plus a subsequent slide showing a tall stealthy superstructure integrating electronic systems, possibly point to a ship with the air defense and eventual railgun/laser weapons of the U.S. Zumwalt-class DDG...

Zhao’s lecture also listed requirements for future “PLAN Aviation Follow Developments,” to include: a “new type carrier-borne fighter;” a “carrier-borne EW [electronic warfare] aircraft;” a “carrier borne fixed AEW [airborne early warning];” a “new type ship-borne ASW [anti-submarine warfare] helicopter;” a “medium-size carrier-borne UAV [unmanned aerial vehicle];” a “stratospheric long-endurance UAV;” and a “stratospheric airship.”¹⁶⁴

Chinese Naval Operations Away from Home Waters

General

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. Although 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.¹⁶⁵ China has been conducting antipiracy operations in waters off Somalia since December 2008 via a succession of rotationally deployed naval escort task forces.

DOD states that China’s naval modernization effort

... aligns with China’s ongoing shift from “near sea” defense to a hybrid strategy of “near sea” defense and “far seas” protection, with the PLAN conducting operational tasks outside the so-called “first island chain” with multi-mission, long-range, sustainable naval platforms that have robust self-defense capabilities.¹⁶⁶

DOD also states that

China’s maritime emphasis and attention to missions guarding its overseas interests have increasingly propelled the PLA beyond China’s borders and its immediate periphery. The PLAN’s evolving focus—from “offshore waters defense” to a mix of “offshore waters defense” and “far seas protection”—reflects the high command’s expanding interest in a wider operational reach. Similarly, doctrinal references to “forward edge defense” that would move potential conflicts far from China’s territory suggest PLA strategists envision an increasingly global role.¹⁶⁷

DOD also states that

The PLAN continues to develop into a global force, gradually extending its operational reach beyond East Asia and into what China calls the “far seas.” The PLAN’s latest naval platforms enable combat operations beyond the reaches of China’s land-based defenses. In particular, China’s aircraft carrier and planned follow-on carriers, once operational,

¹⁶⁴ Richard D. Fisher Jr., “The PLA Navy’s Plan for Dominance: Subs, Shipborne ASBMs, and Carrier Aviation,” Center for International Maritime Security (CIMSEC), October 24, 2017.

¹⁶⁵ DOD states that “China’s “far seas” experience primarily comes from long-distance task group deployments beyond the first island chain and its ongoing counterpiracy mission in the Gulf of Aden. (2017 DOD CMSD, p. 53.)

¹⁶⁶ 2017 DOD CMSD, p. 24.

¹⁶⁷ 2017 DOD CMSD, p. 40.

will extend air defense umbrellas beyond the range of coastal systems and help enable task group operations in “far seas.” The PLAN’s emerging requirement for sea-based land-attack will also enhance China’s ability to project power. More generally, the expansion of naval operations beyond China’s immediate region will also facilitate non-war uses of military force.¹⁶⁸

DOD also states that

The PLAN’s missions in the “far seas” include protecting important sea lanes from terrorism, piracy, and foreign interdiction; providing HA/DR; conducting naval diplomacy and regional deterrence; and training to prevent a third party, such as the United States, from interfering with operations off China’s coast in a Taiwan contingency or conflict in the East or South China Sea. The PLAN’s ability to perform these missions is modest but growing as it gains more experience operating in distant waters and acquires larger and more advanced platforms.¹⁶⁹

The 2015 ONI report states that

Although the PLA(N)’s primary focus remains in the East Asia region, where China faces multiple disputes over the sovereignty of various maritime features and associated maritime rights, in recent years, the PLA(N) has increased its focus on developing blue-water naval capabilities. Over the long term, Beijing aspires to sustain naval missions far from China’s shores.

When we wrote the 2009 publication [i.e., the 2009 ONI report], China had just embarked on its first counterpiracy missions in the Gulf of Aden, but most PLA(N) operations remained close to home. Nearly six years later, these missions have continued without pause, and China’s greater fleet has begun to stretch its legs. The PLA(N) has begun regular combat training in the Philippine Sea, participated in multinational exercises including Rim of the Pacific (RIMPAC) 2014, operated in the Mediterranean, increased intelligence collection deployments in the western Pacific, and for the first time deployed a submarine to the Indian Ocean....

With a greater percentage of the force consisting of these modern combatants capable of blue water operations, the PLA(N) will have an increasing capability to undertake missions far from China.¹⁷⁰

A March 9, 2016, press report states the following:

China's People's Liberation Army Navy (PLAN) has stepped out onto the international scene in recent years with sustained deployments of counter-piracy escort task groups to the Indian Ocean and the Gulf of Aden. These deployments, numbering 22 and counting since 26 December 2008, have enabled the PLAN to sustain presence around the Horn of Africa and even deploy onwards into the Mediterranean Sea and beyond. China is now looking to bolster this strategic presence in both scope and scale by investing in supply ships, using Chinese commercial shipping lines, and exploiting its emerging access to commercial ports around the world as it seeks to provide logistics support to deployed naval vessels.

China has never had a sustained overseas presence or foreign basing footprint. Yet it is building a fleet that will enable the PLAN to deploy not only at high intensity in China's

¹⁶⁸ 2017 DOD CMSD, p. 52.

¹⁶⁹ 2017 DOD CMSD, p. 53.

¹⁷⁰ 2015 ONI Report, p. 5. See also pp. 8, 13, 27, 28-29. See also Andrew Erickson and Christopher Carlson, “Sustained Support: The PLAN Evolves Its Expeditionary Logistics Strategy,” *Jane’s Navy International*, March 9, 2016. See also Todd Crowell, “China Takes to the Blue Water,” *Asia Sentinel*, December 30, 2016.

immediate periphery ('Near Seas', including the Yellow, East, and South China seas), but also with gradually increasing tempo and regularity throughout the Asia-Pacific region and the Indian Ocean ('Far Seas' operations). This ongoing effort, if Beijing seeks for it to become more continuous in nature, will require greater power projection capabilities, as well as enhanced logistics support, and maybe even a long-term presence on foreign soil.¹⁷¹

A March 29, 2017, press report states the following:

The People's Liberation Army Navy [PLAN] Marine Corps is in the midst of a massive reorganization and build out that will greatly enhance China's ability to project power abroad.

At the center of the plan multiplying the relatively small force five times—from about 20,000 uniformed personnel to potentially over 100,000 Marines. This force increase is largely accomplished through folding up to eight PLA amphibious brigades, which were Army units responsible for amphibious missions, into the PLANMC order of battle. This expansion will make the PLANMC more of a full spectrum expeditionary force like the Marine Corps in the United States. Historically, China's Marine Corps was an elite light infantry formation akin to the British Royal Marines....

The expansion and reorganization of China's Marine force is another key aspect of China building up the traditional tools of global power. Akin to the role that U.S. Marines play, they can be stationed at home, potentially based abroad (such as in a future at ports like Gwadar, Pakistan or Djibouti, to secure Chinese trade routes), or aboard PLAN ships. Focus on the maritime will enhance China's ability to carry out amphibious landings as well as deploy light expeditionary forces. A force with the motto of "Tiger of the land, dragon of the sea" is taking a big step forward.¹⁷²

A May 18, 2017, blog post states the following:

On 25 December 2016, the PLAN deployed its Liaoning carrier group beyond the First Island Chain for the first time....

The PLAN's naval drills are not only political exercises and a warning to the US, but also a basis for routine PLAN activities in the future. China's maritime strategy is clearly moving beyond the traditional 'island chain' boundary that has limited the PLAN's operations and development in the past....

The Chinese media's reaction is highly significant in the signals it sends about China's future naval intentions. It makes clear that the most significant barrier to China's development of sea power is not the geopolitical environment or lack of capability but a psychological fixation over the island chains which has become an obstacle to PLAN's formulation of a comprehensive maritime strategy. This intangible mental boundary needlessly prevented development of true sea power....

If China is breaking self-imposed barriers, expect expeditionary deployments to become a routine PLAN activity in the near future. That would also require greater operational support from other PLA arms. In this context, the PLA and PLAAF's Far Sea joint exercise on 2 March suggests that China's Eastern Theater Command aims to increase its

¹⁷¹ Andrew S. Erickson and Christopher P. Carlson, "Sustained Support: the PLAN Evolves Its Expeditionary Logistics Strategy," *IHS Jane's Navy International*, March 9, 2016.

¹⁷² Jeffrey Lin and P.W. Singer, "China's Marine Corps Is Getting Bigger and Stronger," *Popular Science*, March 29, 2017. See also Minnie Chan, "As Overseas Ambitions Expand, China Plans 400 Percent Increase to Marine Corps Numbers, Sources Say," *South China Morning Post*, March 13, 2017.

ability to project power and gain air superiority beyond the mainland to support naval operations.¹⁷³

Bases Outside China

Prior to the establishment of its new military base in Djibouti—China’s first overseas military base (see discussion below)—observers for years had speculated and debated whether, where, and when China might build bases or other logistic support facilities outside China to support Chinese naval operations beyond China’s near-seas region, and particularly along the sea line of communication linking China to Persian Gulf oil sources.¹⁷⁴

Base in Djibouti

DOD stated in 2016 that “in late November 2015, China acknowledged its intent to build military support facilities in Djibouti. When completed, this facility is to be China’s first overseas logistics station.”¹⁷⁵ DOD stated in 2017 that

In February 2016, China began construction of a military base in Djibouti and probably will complete it within the next year. China claims this facility is designed “to help the navy and army further participate in United Nations peacekeeping operations (PKO), carry out escort missions in the waters near Somalia and the Gulf of Aden, and provide humanitarian assistance.” This initiative, along with regular naval vessel visits to foreign ports, both reflects and amplifies China’s growing influence, extending the reach of its armed forces.¹⁷⁶

The facility in Djibouti reportedly was officially “established” on July 11, 2017,¹⁷⁷ and formally opened on August 1, 2017.¹⁷⁸ A September 27, 2017, press report states the following:

China is planning to build a multi-purpose wharf that would allow a naval flotilla to dock at its first overseas military base in Djibouti, according to military sources.

The wharf project will be started only when construction work on accommodation for the People’s Liberation Army marines, engineers and workers stationed in the Horn of Africa nation is completed, one of the sources who is familiar with the project told the South China Morning Post.

¹⁷³ Eli Huang, “China’s PLAN—Breaking Out to Blue Waters,” *Australian Strategic Policy Institute*, May 18, 2017.

¹⁷⁴ See, for example, Kulshrestha, “Jade Necklace: Naval Dimension of Chinese Engagement with Coastal Nations Across the Oceans,” *IndraStra*, December 17, 2016; Peter A. Dutton and Ryan D. Martinson, editors, *Beyond the Wall, Chinese Far Seas Operations*, Newport, RI (Center for Naval Warfare Studies, Naval War College, China Maritime Study No. 13), May 2015, 120 pp.; Christopher H. Sharman, *China Moves Out: Stepping Stones Toward a New Maritime Strategy*, Washington, National Defense University Press, April 2015 (Center for the Study of Chinese Military Affairs, Institute for National Strategic Studies, National Defense University), 45 pp.; Brendan Thomas-Noone, “The Master Plan: Could This Be China’s Overseas Basing Strategy?” *National Interest*, November 6, 2014; Daniel J. Kostecka, “The Chinese Navy’s Emerging Support Network in the Indian Ocean,” *China Brief*, July 22, 2010: 3-5; Eric Ellis, “Pearls for the Orient,” *Sydney Morning Herald*, July 9, 2010.

¹⁷⁵ 2016 DOD CMSD, p. 44. See also Jeremy Page, “China Builds First Overseas Military Post,” *Wall Street Journal*, August 19, 2016; Andrew Jacobs, “U.S. Wary of Its New Neighbor in Djibouti: A Chinese Naval Base,” *New York Times*, February 25, 2017.

¹⁷⁶ 2017 DOD CMSD, p. 5.

¹⁷⁷ See, for example, Zhao Lei, “PLA Establishes Base in Horn of Africa,” *China Daily*, July 12, 2017.

¹⁷⁸ See, for example, Ben Blanchard, “China Formally Opens First Overseas Military Base in Djibouti,” *Reuters*, August 1, 2017.

“Projects such as the multi-purpose naval wharf are complicated. The Chinese navy needs a large-scale pier to offer logistical support for its flotillas conducting anti-piracy operations in Somali waters,” the source said.

“The scale of the wharf should allow for the docking of a four-ship flotilla at least, including China’s new generation Type-901 supply ship with a displacement of more than 40,000 tonnes, destroyers and frigates, as well as amphibious assault ships for combat and humanitarian missions.”

China began building what it describes as a 36-hectare logistics base in Djibouti last year, but satellite images suggest its docking facilities for naval vessels, barracks and other pieces of military infrastructure are still under development....

The source said Beijing was considering the possibility it would have to assist in the mass evacuation of Chinese citizens in an operation similar to the one conducted in war-torn Yemen in 2015—meaning the capacity of the wharf would be designed to be as “big as possible” to allow more warships to dock.

Beijing said the base would resupply vessels taking part in peacekeeping and humanitarian missions off the coasts of Yemen and Somalia.

But another source close to the navy said the wharf had originally been designed as a “naval maintenance and repair port” because of an “accident” in 2010.

“China decided to set up a ship maintenance and repair stop in Djibouti after the power system of its Type-052B destroyer Guangzhou broke down when it was carrying out anti-piracy missions in the Gulf of Aden in May of 2010,” the second source said.

“Sailors on the Guangzhou were facing the most embarrassing situation as they didn’t know where they could go and who they should seek help from because Beijing and Djibouti hadn’t formally set up military ties in that time.”¹⁷⁹

A September 27, 2017, blog post states the following:

The amount of money Chinese firms have spent in Djibouti is just a fraction of what the headlines routinely state. Although this money has engendered considerable goodwill toward China in Djibouti, it is simply too soon to tell whether and to what extent China will be able to translate its financial largesse into influence. Meanwhile, as some analysts suspect, China’s logistics facility in Djibouti probably will be used for more than just refueling and resupplying Chinese navy ships conducting counterpiracy operations in the Gulf of Aden....

... China’s new base is a concrete manifestation of the PLA Navy’s “near seas defense far seas protection”... China’s base in Djibouti is situated in a highly strategic location, directly on the Bab el Mandeb Strait connecting the Gulf of Aden to the Red Sea and on through to the Mediterranean, and near China’s growing economic and commercial interests in East Africa. Given the position of China’s Djibouti base, located along a critical maritime chokepoint and near China’s growing economic and commercial interests in East Africa, it appears the establishment of this facility is an example of China’s new naval strategy in action.¹⁸⁰

An October 1, 2017, press report states the following:

¹⁷⁹ Minnie Chan, “China Plans to Build Djibouti Facility to Allow Naval Flotilla to Dock at First Overseas Base,” *South China Morning Post*, September 27, 2017.

¹⁸⁰ Erica S. Downs and Jeff Becker, “China’s Presence in Djibouti is Not a National Security Threat—Yet,” *National Interest*, September 27, 2017.

Beijing has described its military outpost [in Djibouti] as a logistics facility for resupplying Chinese vessels on peacekeeping and humanitarian missions. But satellite imagery and unofficial reports show the base has military infrastructure, including barracks and storage and maintenance units, and docking facilities that can handle most vessels in its naval fleet.

China was the seventh country to establish a military presence in the small African nation, one of the poorest in the region, following in the footsteps of the United States, France and Japan, among others.

But its base in Djibouti—situated en route to the strategically important Suez Canal, at the mouth of the Red Sea—has stoked concerns it would be a platform for Beijing’s geopolitical ambitions overseas....

Many other countries have a presence in Djibouti, a factor that was critical in Beijing’s decision to build its first overseas military base in the African nation. For example, Djibouti houses the US’ only permanent military installation on the continent.

“It’s less controversial for China to be in Djibouti simply because there are many other countries with a presence there,” said Zhang Baohui, a Lingnan University professor of Chinese foreign policy.

Djibouti is also far from China’s main competitors—a base at Gwadar Port in Pakistan, for example, would have raised alarm in New Delhi.

Zhang said the base’s siting in Djibouti meant China could credibly claim it was for humanitarian missions such as anti-piracy efforts off the coasts of Somalia and Yemen....

China also wants to be able to protect its interests along its “21st century maritime Silk Road”, the sea-based part of Beijing’s expansive “Belt and Road Initiative”, according to Malcolm Davis, Asian security expert at the Australian Strategic Policy Institute.

“There’s lots of Chinese diaspora and investment, and also trade flows in that region,” he said. “It primarily is about being able to have a presence in a strategically important area.”...

According to the CNA report, the Djibouti base can help support China’s missions for “far seas protection” to support operations such as combatting piracy, the evacuation of Chinese citizens, peacekeeping, counterterrorism, intelligence collection and protection of strategic sea lanes.

Analysts say Beijing could use the base to project its power into North Africa, as well as to strengthen its position in the Indian Ocean.

“What it could mean for Chinese ship deployments into the Indian Ocean is they could [maintain] much longer periods of patrolling in the Indian Ocean,” said Rahul Roy-Chaudhury, senior fellow for South Asia at the London-based International Institute for Strategic Studies. “The familiarity of the Chinese navy with the Indian Ocean has increased tremendously.”

But this has raised concern in India about regional maritime security, particularly in view of China’s other regional naval bases in countries such as the Maldives and Sri Lanka, analysts say.¹⁸¹

¹⁸¹ Sarah Zheng, “China’s Djibouti Military Base: ‘Logistics Facility’, or Platform for Geopolitical Ambitions Overseas?” *South China Morning Post*, October 1, 2017. See also Kyle Mizokami, “Satellite Images Spy China’s First Overseas Military Base,” *Popular Mechanics*, November 9, 2017; Abdul Ruff, “China’s First Overseas Base in Africa,” *Modern Diplomacy*, November 4, 2017; John Fei, “China’s Overseas Military Base in Djibouti: Features, Motivations, and Policy Implications,” *China Brief*, December 22, 2017.

Potential Future Bases in Other Locations Outside China

In March 2016, remarks from China’s Foreign Minister were interpreted by some observers as hinting that China might establish additional overseas bases in the future.¹⁸² DOD stated in 2017 that

China’s expanding international economic interests are increasing demands for the PLAN to operate in more distant maritime environments to protect Chinese citizens, investments, and critical sea lines of communication (SLOC).

China most likely will seek to establish additional military bases in countries with which it has a longstanding friendly relationship and similar strategic interests, such as Pakistan, and in which there is a precedent for hosting foreign militaries. China’s overseas military basing may be constrained by the willingness of countries to support a PLA presence in one of their ports.

China’s leaders may judge that a mixture of military logistics models, including preferred access to overseas commercial ports and a limited number of exclusive PLAN logistic facilities—probably collocated with commercial ports—most closely aligns with China’s future overseas military logistics needs.

A greater overseas naval logistics and basing footprint would better position the PLA to expand its participation in non-combatant evacuation operations, search-and-rescue, humanitarian assistance/disaster relief (HA/DR), and SLOC security. A more robust overseas logistics and basing infrastructure would also be essential to enable China to project and sustain military power at greater distances from China.¹⁸³

In March 2017, it was reported that China might deploy a contingent of Chinese marines to the commercial port at Gwadar, Pakistan, to help maintain security at that port.¹⁸⁴

A June 19, 2017, press report states that

a senior Pakistani diplomat confirmed to NBC News that his country invited China to build a naval facility on its territory back in 2011.

“What better way for China to demonstrate clout than to build a military base right in your rival’s backyard?”

““What better way for China to demonstrate clout than to build a military base right in your rival’s backyard?”¹⁸⁵

Speaking on the condition of anonymity, the diplomat said this request came just days after U.S. Navy SEALs conducted a secret raid to kill Osama bin Laden in the Pakistani city of Abbottabad, when relations between Washington and Islamabad took a nosedive.

A September 27, 2017, blog post states that

... while it is likely that Djibouti will not be China’s only military outpost abroad, it may be some time before China establishes another one given China’s cautious approach to Djibouti....

... China is indeed considering other locations for additional overseas bases. An article written by Adm. Sun Jianguo, the deputy chief of the joint staff department responsible

¹⁸² Ben Blanchard, “China Hints More Bases On Way After Djibouti,” *Reuters*, March 8, 2016.

¹⁸³ 2017 DOD CMSD, p. 5. The passage as reprinted here omits bullet marks that precede the first two paragraphs.

¹⁸⁴ “China May Deploy Marines to Gwadar Port,” *Maritime Executive*, March 16, 2017.

¹⁸⁵ Wajahat S. Khan, “China May Soon Establish Naval Base in U.S. Ally Pakistan,” *NBC News*, June 19, 2017.

for the PLA's overseas engagement portfolio, and published in Qiushi, the official journal of the Central Committee of the Communist Party of China School, President Xi Jinping has instructed the PLA to "steadily advance overseas base construction." In March 2016, in response to a reporter's question about how China will protect its overseas interests, China's foreign minister Wang Yi simply stated, "We are willing to try to carry out the construction of infrastructure facilities and logistic capacity in the regions where China's interest is involved." This is a far cry from past statements by China's Foreign Ministry spokesmen, who would decry as "groundless" the first hint of any such rumor that the PLA may be interested setting up overseas.

Chinese military analysts have already publicly speculated about several potential locations. Analysts at China's Naval Research Institute, the PLA Navy's top think tank, have proposed locations ranging from Gwadar, Pakistan and Hambantota, Sri Lanka in South Asia, to Sittwe, Myanmar in Southeast Asia, and even Dar es Salaam, south of Djibouti on Africa's east coast in Tanzania. Each of these locations have their own unique sets of challenges for China, however, and given the excessive caution with which China moved in establishing its first location in Djibouti, it may be quite some before we see a second.¹⁸⁶

An October 5, 2017, press report states the following:

China's first overseas military base in the small African country of Djibouti is "probably the first of many" the country intends to build around the world, which could bring its interests into conflict with the U.S., according to American intelligence officials.

"China has the fastest-modernizing military in the world next to the United States," according to insights provided Thursday by U.S. intelligence officials, who asked not to be identified discussing the information. That will create "new areas of intersection—and potentially conflicting—security interests between China and the United States and other countries abroad," according to the officials.¹⁸⁷

A January 3, 2018, press report states the following:

The facility will be built at Jiwani, a port close to the Iranian border on the Gulf of Oman, according to two people familiar with deal.

Plans call for the Jiwani base to be a joint naval and air facility for Chinese forces, located a short distance up the coast from the Chinese-built commercial port facility at Gwadar, Pakistan. Both Gwadar and Jiwani are part of Pakistan's western Baluchistan province.

Plans for the base were advanced during a visit to Jiwani on Dec. 18 by a group of 16 Chinese People's Liberation Army officers who met with about 10 Pakistani military officers. Jiwani is located on a peninsula about 15 miles long on a stretch of land with one small airfield.

According to sources, the large naval and air base will require the Pakistani government to relocate scores of residents living in the area. Plans call for their relocation to other areas of Jiwani or further inland in Baluchistan province.

The Chinese also asked the Pakistanis to undertake a major upgrade of Jiwani airport so the facility will be able to handle large Chinese military aircraft. Work on the airport improvements is expected to begin in July.

¹⁸⁶ Erica S. Downs and Jeff Becker, "China's Presence in Djibouti is Not a National Security Threat—Yet," *National Interest*, September 27, 2017.

¹⁸⁷ Nafeesa Syeed, "U.S. Intelligence Sees China's Military Expanding Bases Globally," *Bloomberg*, October 5, 2017.

The naval base and airfield will occupy nearly the entire strategic peninsula.¹⁸⁸

A January 30, 2018, press report stated the following:

According to recent reports, China may be about to construct a naval and air base near Gwadar, in west Pakistan. This would be China's second base in the Indian Ocean and indicates that it may be moving fast to establish a network of military bases across the region....

The Djibouti base is only the first step in what is likely to become a network of Chinese bases across the Indian Ocean. Many analysts had long thought that the next Chinese naval base would be established at Gwadar. The port city is on track to become a major waypoint in China's Belt and Road Initiative and the Indian Ocean node of a new overland pathway to western China.

China's plans for Gwadar are ambitious. There are reports that it is planning to build accommodation for up to 500,000 Chinese nationals in Gwadar within five years, and it seems likely they will be accompanied by a large contingent of Chinese marines. This would overwhelm Gwadar's existing population of around 100,000 people, effectively making Gwadar China's first colony in the Indian Ocean....

This month, a US report¹⁸⁹ claimed that China is about to start construction of a new naval base and airfield at Jiwani, some 60 kilometres west of Gwadar. While this has not been confirmed by Beijing, Jiwani would make a good location for a base. It would separate Chinese naval forces from commercial shipping at Gwadar....

Chinese facilities at Djibouti and Gwadar/Jiwani are unlikely to be the end of China's expanding military presence in the Indian Ocean. China will also require facilities or staging points in or around east Africa, to help protect its massive energy trade from West Africa travelling around the Cape.

There are a number of potential candidates among the weak and underdeveloped countries in that part of the world. Many analysts think Tanzania would be a good location. China has a close and longstanding relationship with Tanzania and recently took control of the newly built port of Bagamoyo, around 50 kilometres north of the Dar es Salaam.

China will also likely require naval facilities in the central and/or eastern Indian Ocean as part of a new Indian Ocean network. China recently took control of the port of Hambantota in southern Sri Lanka, leading to a lot of speculation about Beijing's intentions. But the Sri Lankan government strenuously denies that China will be permitted to develop any naval presence there, and it has previously given formal undertakings to India that it would not do so.

Other analysts look at the Maldives islands south of India as a likely place for a Chinese base. Although traditionally within India's strategic sphere, in recent years the Maldives has become unstable, impoverished and increasingly desperate.¹⁹⁰

¹⁸⁸ Bill Gertz, "China Building Military Base in Pakistan," *Washington Times*, January 3, 2018. See also "China to Deploy Nuclear Submarines at Pakistan's Gwadar Port," *India.com*, January 17, 2018; Cristina Maza, "Why Is China Building a Military Base in Pakistan, America's Newest Enemy?" *Newsweek*, January 5, 2018; Minnie Chan, "First Djibouti ... Now Pakistan Port Earmarked for a Chinese Overseas naval Base, Sources Say," *South China Morning Post*, January 5, 2018.

¹⁸⁹ The article at this point contains a live link to Bill Gertz, "China Building Military Base in Pakistan," *Washington Times*, January 3, 2018.

¹⁹⁰ David Brewster, "China's New Network of Indian Ocean Bases," *The Interpreter*, January 30, 2018.

In addition to the above points about potential future military bases, it was reported in November and December 2015 that a Chinese commercial firm had purchased a port near Darwin, Australia, leading to a discussion among Australian and U.S. observers as to whether this development posed a security threat to U.S. naval forces that might operate out of Darwin.¹⁹¹

Numbers of Chinese Ships and Aircraft; Comparisons to U.S. Navy

Numbers Provided by ONI

Numbers Provided by ONI in 2015

The 2015 ONI report states that

- “the PLA(N) currently possesses more than 300 surface combatants, submarines, amphibious ships, and missile-armed patrol craft”;¹⁹² that
- “the PLA(N) [surface force] consists of approximately 26 destroyers (21 of which are considered modern), 52 frigates (35 modern), 20 new corvettes, 85 modern missile-armed patrol craft, 56 amphibious ships, 42 mine warfare ships (30 modern), more than 50 major auxiliary ships, and more than 400 minor auxiliary ships and service/support craft”;¹⁹³ and that
- “currently, the [PLA(N)] submarine force consists of five nuclear attack submarines, four nuclear ballistic missile submarines, and 57 diesel attack submarines.”¹⁹⁴

Numbers Provided by ONI in 2013

Table 4 shows figures provided by ONI in 2013 on numbers of Chinese navy ships in 2000, 2005, and 2010, and projected figures for 2015 and 2020, along with the approximate percentage of ships within these figures considered by ONI to be of modern design.

¹⁹¹ See, for example, Jane Perlez, “U.S. Casts Wary Eye on Australian Port Leased by Chinese,” *New York Times*, March 20, 2016; Patrick Cronin and Phoebe Benich, “The Port of Darwin As a ‘Gray Zone’ Situation,” *ASPI Strategist*, November 27, 2015; Lauren Dickey, “What Are the Chinese up to in Australia?” *War on the Rocks*, December 3, 2015; Jason Scott, “China Spy Fears Over Aussie Port Deal Are Absurd, [Australian] Defense Says,” *Bloomberg News*, December 14, 2015.

¹⁹² *2015 ONI Report*, p. 13.

¹⁹³ *2015 ONI Report*, p. 15.

¹⁹⁴ *2015 ONI Report*, p. 18.

Table 4. Numbers of PLA Navy Ships Provided by ONI in 2013

(Figures for numbers of ships include both older and less capable units—including some of questionable operational status—and newer and more capable units)

Ship type	2000	2005	2010	2015	2020
Numbers					
Diesel attack submarines (SSs)	60	51	54	57 to 62	59 to 64
Nuclear-powered attack submarines (SSNs)	5	6	6	6 to 8	6 to 9
Ballistic missile submarines	1	2	3	3 to 5	4 to 5
Aircraft carriers	0	0	0	1	1 to 2
Destroyers	21	21	25	28 to 32	30 to 34
Frigates	37	43	49	52 to 56	54 to 58
Corvettes	0	0	0	20 to 25	24 to 30
Amphibious ships	60	43	55	53 to 55	50 to 55
Missile-armed coastal patrol craft	100	51	85	85	85
Approximate percent of modern design					
Diesel attack submarines	7	40	50	70	75
Nuclear-powered attack submarines	0	33	33	70	100
Destroyers	20	40	50	70	85
Frigates	25	35	45	70	85

Source: Craig Murray, Andrew Berglund, and Kimberly Hsu, *China's Naval Modernization and Implications for the United States*, U.S.-China Economic and Security Review Commission (USCC), August 26, 2013, Figures 1 through 4 on pp. 6-7. The source notes to Figures 1 through 4 state that the numbers and percentages “were provided by the U.S. Office of Naval Intelligence. U.S. Office of Naval Intelligence, *PLA Navy Orders of Battle 2000-2020*, written response to request for information provided to the U.S.-China Economic and Security Review Commission, Suitland, MD, June 24, 2013.” Citing this same ONI document, the USCC publication states in footnotes on pages 6 and 7 that “Modern submarines are those able to employ submarine-launched intercontinental ballistic missiles or antiship cruise missiles,” and that “Modern surface ships are those able to conduct multiple missions or that have been extensively upgraded since 1992.”

Numbers Provided by ONI in 2009

Table 5 shows figures provided by ONI in 2009 on numbers of Chinese navy ships and aircraft from 1990 to 2009, and projected figures for 2015 and 2020. The figures in the table lump older and less capable ships together with newer and more capable ships discussed above.

Table 5. Numbers of PLA Navy Ships and Aircraft Provided by ONI in 2009

(Figures include both older and less capable units—including some of questionable operational status—and newer and more capable units)

	1990	1995	2000	2005	2009	Projection for 2015	Projection for 2020
Ships							
Ballistic missile submarines	1	1	1	2	3	4 or 5?	4 or 5?
Attack submarines (SSNs and SSs)	80	82	65	58	59	~70	~72
SSNs	5	5	5	6	6	n/a	n/a
SSs	75	77	60	52	53	n/a	n/a
Aircraft carriers	0	0	0	0	0	1?	2?
Destroyers	14	18	21	25	26	~26	~26
Frigates	35	35	37	42	48	~45	~42
Subtotal above ships	130	136	124	127	136	~146 or ~147?	~146 or ~147?
Missile-armed attack craft	200	165	100	75	80+	n/a	n/a
Amphibious ships	65	70	60	56	58	n/a	n/a
Large ships (LPDs/LHDs)	0	0	0	0	1	~6?	~6?
Smaller ships	65	70	60	56	57	n/a	n/a
Mine warfare ships	n/a	n/a	n/a	n/a	40	n/a	n/a
Major auxiliary ships	n/a	n/a	n/a	n/a	50	n/a	n/a
Minor auxiliary ships and support craft	n/a	n/a	n/a	n/a	250+	n/a	n/a
Aircraft							
Land-based maritime strike aircraft	n/a	n/a	n/a	n/a	~145	~255	~258
Carrier-based fighters	0	0	0	0	0	~60	~90
Helicopters	n/a	n/a	n/a	n/a	~34	~153	~157
Subtotal above aircraft	n/a	n/a	n/a	n/a	~179	~468	~505

Source: Prepared by CRS. Source for 2009, 2015, and 2020: 2009 ONI report, page 18 (text and table), page 21 (text), and (for figures not available on pages 18 or 21), page 45 (CRS estimates based on visual inspection of ONI graph entitled “Estimated PLA[N] Force Levels”). Source for 1990, 1995, 2000, and 2005: Navy data provided to CRS by Navy Office of Legislative Affairs, July 9, 2010.

Notes: n/a is not available. The use of question marks for the projected figures for ballistic missile submarines, aircraft, carriers, and major amphibious ships (LPDs and LHDs) for 2015 and 2020 reflects the difficulty of resolving these numbers visually from the graph on page 45 of the ONI report. The graph shows more major amphibious ships than ballistic missile submarines, and more ballistic missile submarines than aircraft carriers. Figures in this table for aircraft carriers include the *Liaoning*. The ONI report states on page 19 that China “will likely have an operational, domestically produced carrier sometime after 2015.” Such a ship, plus the *Liaoning*, would give China a force of 2 operational carriers sometime after 2015.

The graph on page 45 shows a combined total of amphibious ships and landing craft of about 244 in 2009, about 261 projected for 2015, and about 253 projected for 2015.

Since the graph on page 45 of the ONI report is entitled “Estimated PLA[N] Force Levels,” aircraft numbers shown in the table presumably do not include Chinese air force (PLAAF) aircraft that may be capable of attacking ships or conducting other maritime operations.

Numbers Presented in Annual DOD Reports to Congress

DOD states that “The PLAN is the largest navy in Asia, with more than 300 surface ships, submarines, amphibious ships, and patrol craft.”¹⁹⁵ and that “The PLAN has the largest force of principal combatants, submarines, and amphibious warfare ships in Asia.”¹⁹⁶ **Table 6** shows numbers of Chinese navy ships as presented in annual DOD reports to Congress on military and security developments involving China (previously known as the annual report on China military power). As with **Table 5**, the figures in **Table 6** lump older and less capable ships together with newer and more capable ships discussed above. DOD stated in 2011 that the percentage of modern units within China’s submarine force has increased from less than 10% in 2000 and 2004 to about 47% in 2008 and 50% in 2009, and that the percentage of modern units within China’s force of surface combatants has increased from less than 10% in 2000 and 2004 to about 25% in 2008 and 2009.¹⁹⁷

¹⁹⁵ 2017 DOD CMSD, p. 24.

¹⁹⁶ 2017 DOD CMSD, p. 94.

¹⁹⁷ 2011 DOD CMSD, p. 43 (figure).

Table 6. Numbers of PLA Navy Ships Presented in Annual DOD Reports to Congress

(Figures include both older and less capable units—including some of questionable operational status—and newer and more capable units)

Year of DOD report	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ballistic missile submarines	1	1	1	n/a	1	1	1	1	2	2	2	2	3	3	4	4	4
Nuclear-powered attack submarines	5	5		n/a	6	5	5	5	6	6	5	5	5	5	5	5	5
			~60														
Diesel attack submarines	~60	~ 50		n/a	51	50	53	54	54	54	49	48	49	51	53	57	54
Aircraft carriers	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Destroyers	~20			n/a	21	25	25	29	27	25	26	26	23	24	21	23	31
Frigates	~40	~ 60	> 60	n/a	43	45	47	45	48	49	53	53	52	49	52	52	56
Corvettes	0	0	0	0	0	0	0	0	0	0	0	0	0	8	15	23	23
Missile-armed coastal patrol craft	n/a	~ 50	~ 50	n/a	51	45	41	45	70	85	86	86	85	85	86	86	88
Amphibious ships: LSTs and LPDs				n/a	20	25	25	26	27	27	27	28	29	29	29	30	34
	almost 50	~ 40	> 40														
Amphibious ships: LSMs				n/a	23	25	25	28	28	28	28	23	26	28	28	22	21

Source: Table prepared by CRS based on 2000-2016 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).

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 2016 edition of the report covers events during 2015.

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 numbers of ships (or aggregate fleet tonnages) can be relatively easy to compile from published reference sources, they are highly problematic as a means of assessing relative U.S. and Chinese naval capabilities, for the following reasons:

- **A fleet’s total number of ships (or its aggregate tonnage) is only a partial metric of its capability.** In light of the many other significant contributors to naval capability,¹⁹⁸ 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 valid, and today is highly problematic.
- **Total numbers of ships of a given type (such as submarines, destroyers, or frigates) can obscure potentially significant differences in the capabilities of those ships, both between navies and within one country’s navy.**¹⁹⁹ The potential for obscuring differences in the capabilities of ships of a given type is particularly significant in assessing relative U.S. and Chinese capabilities, in part because China’s navy includes significant numbers of older, obsolescent ships. Figures on total numbers of Chinese submarines, destroyers, frigates, and coastal patrol craft lump older, obsolescent ships together with more modern and more capable designs.²⁰⁰ This CRS report shows numbers of more modern and more capable submarines, destroyers, and frigates in **Table 1**, **Table 2**, and **Table 3**, respectively.
- **A focus on total ship numbers reinforces the notion that increases in total numbers necessarily translate into increases in aggregate capability, and that decreases in total numbers necessarily translate into decreases in aggregate capability.** For a Navy like China’s, which is modernizing in some ship categories by replacing larger numbers of older, obsolescent ships with smaller numbers of more modern and more capable ships, this is not necessarily the case. As shown in **Table 5**, for example, China’s submarine force today has fewer boats than it did in 1990, but has greater aggregate capability than it did in 1990, because larger numbers of older, obsolescent boats have been replaced by

¹⁹⁸ These include types (as opposed to numbers or aggregate tonnage) 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.

¹⁹⁹ 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).

²⁰⁰ For an article discussing this issue, see Joseph Carrigan, “Aging Tigers, Mighty Dragons: China’s bifurcated Surface Fleet,” *China Brief*, September 24, 2010: 2-6.

smaller numbers of more modern and more capable boats. A similar point might be made about China's force of missile-armed attack craft. For assessing navies like China's, it can be more useful to track the growth in numbers of more modern and more capable units. This CRS report shows numbers of more modern and more capable submarines, destroyers, and frigates in **Table 1**, **Table 2**, and **Table 3**, respectively.

- **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 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.²⁰¹

DOD Response to China Naval Modernization

2017 National Security Strategy and 2018 National Defense Strategy

The Trump Administration's December 2017 National Security Strategy (NSS)²⁰² and the 11-page unclassified summary of its January 2018 National Defense Strategy (NDS)²⁰³ reorient U.S.

²⁰¹ 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.

²⁰² Office of the President, *National Security Strategy of the United States of America*, December 2017, 55 pp.

²⁰³ Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*, undated but released January 2018, 11 pp.

national security strategy and, within that, U.S. defense strategy, toward an explicit primary focus on great power competition with China and Russia and on countering Chinese and Russian military capabilities. The new U.S. strategy orientation set forth in the 2017 NSS and 2018 NDS is sometimes referred to a “2+3” strategy, meaning a strategy for countering two primary challenges (China and Russia) and three additional challenges (North Korea, Iran, and terrorist groups).²⁰⁴

Concept of a Free and Open Indo-Pacific (FOIP)

In addition to the 2017 NSS and 2018 NDS, the Trump Administration has highlighted the concept of a free and open Indo-Pacific (FOIP), with the term Indo-Pacific referring to the Indian Ocean, the Pacific Ocean, and the countries (particularly those in Eurasia) bordering on those two oceans. The concept, which is still being fleshed out by the Trump Administration, appears to be a general U.S. foreign policy and national security construct for the region, but observers view it as one that includes a military component.²⁰⁵

Efforts to Preserve U.S. Military Superiority

DOD in recent years has taken a number of actions in recent years that are intended to help maintain U.S. military superiority over improving military capabilities of other countries, such as China. During the Obama Administration, these steps included the following:

- **Strategic Capabilities Office (SCO).** DOD in 2012 created the Strategic Capabilities Office (SCO), an organization that Secretary of Defense Ashton Carter described on February 2, 2016, as one that “re-imagine[s] existing DOD and intelligence community and commercial systems by giving them new roles and game-changing capabilities to confound potential enemies,” with an emphasis on fielding capabilities within a few years, rather than in 10 or 15 years.²⁰⁶
- **Defense Innovation Initiative.** To help arrest and reverse an assessed decline in the U.S. military’s technological and qualitative edge over the opposing military forces, DOD in November 2014 announced a new Defense Innovation Initiative.²⁰⁷

²⁰⁴ For more on the 2017 NSS and 2018 NDS, see CRS Insight IN10842, *The 2017 National Security Strategy: Issues for Congress*, by (name redacted), and CRS Insight IN10855, *The 2018 National Defense Strategy*, by (name redacted).

²⁰⁵ For more on the Indo-Pacific, see CRS Insight IN10888, *Australia, China, and the Indo-Pacific*, by (name redacted); CRS In Focus IF10726, *China-India Rivalry in the Indian Ocean*, by (name redacted); and CRS In Focus IF10199, *U.S.-Japan Relations*, coordinated by (name redacted).

²⁰⁶ Remarks by Secretary Carter on the Budget at the Economic Club of Washington, DC, February 2, 2016, accessed March 30, 2016, at <http://www.defense.gov/News/News-Transcripts/Transcript-View/Article/648901/remarks-by-secretary-carter-on-the-budget-at-the-economic-club-of-washington-dc>. See also Sam LaGrone, “Little Known Pentagon Office Key to U.S. Military Competition with China, Russia,” *USNI News*, February 2, 2016; Jason Sherman, “Carter Lifts the Veil on Classified Work of Secretive Strategic Capabilities Office,” *Inside the Pentagon*, February 4, 2016; Colin Clark and Sydney J. Freedberg Jr., “Robot Boats, Smart Guns & Super B-52s: Carter’s Strategic Capabilities Office,” *Breaking Defense*, February 5, 2016; Dan Lamothe, “Veil of Secrecy Lifted on Pentagon Office Planning ‘Avatar’ Fighters and Drone Swarms,” *Washington Post*, March 8, 2016; Anthony Capaccio, “Once-Secret Pentagon Agency Asks Industry to Help Find New Ideas,” *Bloomberg*, March 29, 2016; Reuters, “New ‘Take Risk’ Office Rebuilds Navy’s Arsenal,” *Maritime Executive*, March 29, 2016.

²⁰⁷ See, for example, Cheryl Pellerin, “Hagel Announces New Defense Innovation, Reform Efforts,” *DOD News*, November 15, 2014; Jake Richmond, “Work Explains Strategy Behind Innovation Initiative,” *DOD News*, November (continued...)

- **A Long-Range Research and Development Plan (LRRDP).** In February 2015, DOD stated that in October 2014, it had launched a Long-Range Research and Development Plan (LRRDP) to “identify high-payoff enabling technology investments that could help shape future U.S. materiel investments and the trajectory of future competition for technical superiority. The plan will focus on technology that can be moved into development programs within the next five years.”²⁰⁸
- **Third Offset Strategy.** DOD in 2015 also announced that it was seeking a new general U.S. approach—a so-called “third offset strategy”—for maintaining U.S. superiority over opposing military forces that are both numerically large and armed with precision-guided weapons.²⁰⁹ A December 5, 2016, press report suggests that the Third Offset Strategy includes something called “The China Strategic Initiative.”²¹⁰

It is not yet clear how the above initiatives will be maintained or altered by the Trump Administration. The 2018 NDS, however, places a strong emphasis on achieving greater speed in developing and deploying new weapons and military technologies:

Deliver performance at the speed of relevance. Success no longer goes to the country that develops a new technology first, but rather to the one that better integrates it and adapts

(...continued)

24, 2014; and memorandum dated November 15, 2015, from Secretary of Defense Chuck Hagel to the Deputy Secretary of Defense and other DOD recipients on The Defense Innovation Initiative, accessed online on July 21, 2015, at <http://www.defense.gov/pubs/OSD013411-14.pdf>.

²⁰⁸ Cheryl Pellerin, “DoD Seeks Novel Ideas to Shape Its Technological Future,” *DoD News*, February 24, 2015.

²⁰⁹ See Deputy Secretary of Defense Speech, Reagan Defense Forum: The Third Offset Strategy, As Delivered by Deputy Secretary of Defense Bob Work, Reagan Presidential Library, Simi Valley, CA, November 7, 2015, accessed December 21, 2015, at <http://www.defense.gov/News/Speeches/Speech-View/Article/628246/reagan-defense-forum-the-third-offset-strategy>, and Deputy Secretary of Defense Speech, CNAS Defense Forum, As Delivered by Deputy Secretary of Defense Bob Work, JW Marriott, Washington, DC, December 14, 2015, accessed December 21, 2015, at <http://www.defense.gov/News/Speeches/Speech-View/Article/634214/cnas-defense-forum>. See also Jason Sherman, “DOD Unveils Technology Areas That Will Drive ‘Third Offset’ Investments, Experimentation,” *InsideDefense.com Daily News*, December 9, 2014; Aaron Mehta, “Work Outlines Key Steps in Third Offset Tech Development,” *Defense News*, December 14, 2015; Jon Harper, “2017 Budget Proposal to Include Billions for Next-Generation Weapons Research,” *National Defense*, December 14, 2015; Tony Bertuca, “Work Pegs FY-17 ‘Third Offset’ Investment at \$12B-\$15B,” *InsideDefense.com Daily News*, December 14, 2015; Jason Sherman, “DOD ‘Red Teams’ Aim to Anticipate Russia, Chinese Reaction to ‘Third Offset Strategy,’” *Inside the Pentagon*, December 22, 2016; Kyle Mizokami, “America’s Military is Getting Deadly Serious About China, Russia, and North Korea,” *The Week*, February 10, 2016; Mackenzie Eaglen, “What is the Third Offset Strategy?” *Real Clear Defense*, February 16, 2016; Tony Bertuca, “DOD Breaks Down ‘Third Offset’ FYDP Investments,” *Inside the Pentagon*, February 17, 2016; David Ignatius, “The Exotic New Weapons the Pentagon Wants to Deter Russia and China,” *Washington Post*, February 23, 2016; Amaani Lyle, “Pentagon: New Technology Deters Russia, China,” *Scout*, March 13, 2016; Shawn Brimley and Loren DeJonge Schulman, “Sustaining the Third Offset Strategy in the Next Administration,” *War on the Rocks*, March 15, 2016.

²¹⁰ The press report states:

Last week’s meeting between Joint Chiefs Chairman Gen. Joe Dunford and the incoming administration’s transition team included a dialogue that touched on the goals of the Third Offset Strategy and how it is organized, according to Deputy Defense Secretary Robert Work.

“We pretty much showed them... the whole organization we put together: The China Strategic Initiative, the Russian Strategic Initiative, reinvigoration of [Office of Net Assessment],” Work said of the Pentagon’s Third Offset presentation to the team.

(Ellen Mitchell, “Pentagon Played Out Third Offset Strategy for Trump Transition Team,” *Politico Pro Defense Whiteboard*, December 5, 2016. Ellipse and bracketed material as in original.)

its way of fighting. Current processes are not responsive to need; the Department is over-optimized for exceptional performance at the expense of providing timely decisions, policies, and capabilities to the warfighter. Our response will be to prioritize speed of delivery, continuous adaptation, and frequent modular upgrades. We must not accept cumbersome approval chains, wasteful applications of resources in uncompetitive space, or overly risk-averse thinking that impedes change. Delivering performance means we will shed outdated management practices and structures while integrating insights from business innovation.²¹¹

Joint Concept for Access and Maneuver in Global Commons (JAM-GC)

DOD has developed a concept, originally called Air-Sea Battle (ASB) and later called Joint Concept for Access and Maneuver in the Global Commons (JAM-GC),²¹² for increasing the joint operating effectiveness of U.S. naval and Air Force units, particularly in operations for countering adversary anti-access/area-denial (A2/AD) forces. DOD announced the concept in the 2010 Quadrennial Defense Review. Although DOD officials stated that the concept is not directed at any particular adversary, many observers believe it is focused to a large degree, if not principally, on countering Chinese, Russian, and Iranian anti-access forces. On June 3, 2013, DOD released an unclassified summary of the concept; the document builds on earlier statements from DOD officials on the topic. A January 6, 2016, press report states the following:

The Defense Department's Joint Concept for Access and Maneuver in the Global Commons is nearing completion, as the military services and combatant commands are currently reviewing the draft document, according to an official involved in the concept's development.

The concept, termed JAM-GC, is in the second round of coordination with the services and the COCOMs, according to Capt. Michael Hutchens, director of the Air-Sea Battle office within the Office of the Chief of Naval Operations (N3/N5). Following their review, the document will then go through "tank sessions" for the operational deputies and the Joint Chiefs of Staff sometime in 2016....²¹³

For more on JAM-GC, see **Appendix C**.

Navy Response to China Naval Modernization

May 2017 CNO White Paper

A May 17, 2017, white paper by Admiral John Richardson, the Chief of Naval Operations (CNO), on the future U.S. Navy states the following in part:

There is broad agreement that the current security environment is faster paced, more complex, and increasingly competitive. Time is an unforgiving characteristic of that

²¹¹ Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*, undated but released January 2018, p. 10.

²¹² In February 2015, it was reported that the name of the concept was being changed from Air-Sea Battle to Joint Concept for Access and Maneuver in the Global Commons (JAM-GC). See Terry S. Morris et al., "Securing Operational Access: Evolving the Air-Sea Battle Concept," *National Interest*, February 11, 2015. See also Paul McLeary, "New US Concept Mends Air, Sea and Land," *Defense News*, January 24, 2015; James Holmes, "Redefining AirSea Battle: JAM-GC, China and the Quest for Clarity," *National Interest*, November 22, 2015; Harry J. Kazianis, "Air-Sea Battle's Next Step: JAM-GC on Deck," *National Interest*, November 25, 2015.

²¹³ Justin Doubleday, "Draft DOD Joint Concept Nearing Completion, Getting Input From Services, COCOMs," *Inside the Pentagon*, January 6, 2016.

environment—things are moving faster, including our competitors. More and more often you hear one word to describe the pace: exponential. In many ways, information technology is driving this. But the pace is quickening everywhere. As Chairman of the Joint Chiefs of Staff General Dunford has made clear, more and more of our challenges are multi-domain, trans-regional, and multi-functional.

This exponential and complex dynamic is playing out on the seas....

These changes are shifting the character of naval competition and warfare, and are being exploited, to varying degrees, by a range of competitors. Both China and Russia are able to compete on a global scale, in all domains, and at competitive speed. They both possess considerable space, cyber, and nuclear forces. Both are challenging U.S. influence and interests in expanding areas of the world, often in maritime spaces. They have been very explicit about their maritime intentions, and have moved out smartly to advance them. China's 2015 white paper asserted that "[t]he traditional mentality that land outweighs sea must be abandoned...It is necessary for China to develop a modern maritime military force structure commensurate with its national security and development interests...so as to provide support for building itself into a maritime power." This goal is reflected in China's shipbuilding efforts, which analysts recently characterized as proceeding at a "frenetic pace," with the fleet "modernizing at an incredible rate [that] shows no signs of abating." As just two examples, until 2009, China had a single ballistic missile submarine; it has added another three since. And the Chinese Navy commissioned 18 ships last year. China has used this growing and modernized fleet to sail all over the world, visiting ports across the globe and establishing new overseas bases....

To address this rapidly changing security environment and achieve its mission, the Navy must provide a balanced fleet that offers U.S. leaders credible options, in places of strategic importance, at a relevant speed. That Navy is achieved through a fleet design and a resultant fleet architecture that is powerful enough to achieve U.S. aims without conflict, but, if deterrence fails, to win quickly and decisively. The pace at which potential competitors are moving demands that we in turn increase the speed at which we act. Our advantage is shrinking—we must reverse this trend....

The fleet must be larger and more powerful. But the urgent problem before us is that all studies show the need for more naval power, and without determined action, we will indeed see the Navy becomes less powerful. So we must rapidly increase the number and capability of platforms: we must get to a higher build rate from which we continue to work our way forward. We must arm those platforms with more effective, modernized payloads. We must make better use of sensor and communications apertures. We must operate on networks that will degrade more gracefully and heal faster than those of our rivals. Most importantly, the future fleet must be on station ASAP! We need this more powerful fleet in the 2020s, not the 2040s. To do that, we must get more capability out of what we already own, and bring new technologies and platforms into the mix as rapidly as possible....

The competition is on, and pace dominates. In an exponential competition, the winner takes all. We must shake off any vestiges of comfort or complacency that our previous advantages may have afforded us, and move out to build a larger, more distributed, and more capable battle fleet that can execute our mission. The foundation of that fleet will be leaders and teams who learn and adapt to achieve maximum possible performance, ready for decisive operations and combat.

Time is of the essence.²¹⁴

²¹⁴ John Richardson, *The Future Navy*, May 17, 2017, pp. 1-3, 9.

The U.S. Navy has taken a number of steps in recent years that appear intended, at least in part, for improving the U.S. Navy's ability to counter Chinese maritime A2/AD capabilities, including but not limited to those discussed below.

Force Posture and Basing Actions

Navy force posture and basing actions include the following, among others:

- The final report on the 2006 Quadrennial Defense Review (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.”²¹⁵
- More generally, the Navy intends to increase the share of its ships that are homeported in the Pacific from the current figure of about 55% to 60% by 2020.
- The Navy stated in 2014 that, budgets permitting, the Navy will seek to increase the number of Navy ships that will be stationed in or forward-deployed to the Pacific on a day-to-day basis from 51 in 2014 to 58 in 2015 and 67 by 2020.²¹⁶
- The Navy will increase the number of attack submarines homeported at Guam to four, from a previous total of three.²¹⁷
- The Navy has announced an intention to station up to four Littoral Combat Ships (LCSs) at Singapore,²¹⁸ and an additional seven LCSs in Japan.²¹⁹
- In terms of qualitative improvements, the Navy has stated that it will assign its newest and most capable ships and aircraft, and its most capable personnel, to the Pacific.²²⁰
- In April 2014, the United States and the Philippines signed an agreement that to provide U.S. forces with increased access to Philippine bases.²²¹
- In September 2015, the U.S. Pacific Fleet Commander raised the idea of having the U.S. Third Fleet (the fleet for the Eastern Pacific—the part of the Pacific

²¹⁵ U.S. Department of Defense, *Quadrennial Defense Review Report*. Washington, 2006. (February 6, 2006) p. 47.

²¹⁶ Victor Battle, “US Navy ‘Shaping Events’ in South China Sea,” *VOA News* (www.voanews.com), May 20, 2014. See also Mike McCarthy, “CNO Sees More Integration With Asian Allies,” *Defense Daily*, May 20, 2014: 1-2.

²¹⁷ “Fourth Attack Sub to be Homeported in Guam,” *Navy News Service*, February 10, 2014.

²¹⁸ Jim Wolf, “U.S. Plans 10-Month Warship Deployment To Singapore,” *Reuters.com*, May 10, 2012; Jonathan Greenert, “Sea Change, The Navy Pivots to Asia,” *Foreign Policy* (<http://www.foreignpolicy.com>), November 14, 2012.

²¹⁹ Zachary Keck, “U.S. Chief of Naval Operations: 11 Littoral Combat Ships to Asia by 2012,” *The Diplomat* (<http://thediplomat.com>), May 17, 2013.

²²⁰ See, for example, Richard Sisk, “All Three Zumwalt Class Destroyers to Be Assigned to Pacific: Carter,” *Military.com*, April 8, 2016.

²²¹ See, for example, Mark Landler, “U.S. and Philippines Agree to a 10-Year Pact on the Use of Military Bases,” *New York Times*, (<http://www.nytimes.com>), April 27, 2014; Associated Press, “Obama Says US-Philippines Military Pact Will Improve Asia’s Security,” *Fox News* (<http://www.foxnews.com>), April 28, 2014; Luis Ramirez, “US-Philippines Defense Deal to Improve Asia Security,” *VOA News* (<http://www.voanews.com>), April 28, 2014; Armando J. Heredia, “New Defense Agreement Between The Philippines and U.S.: The Basics,” *USNI News* (<http://news.usni.org>), April 29, 2014; Ankit Panda, “US-Philippines Enhanced Defense Cooperation Agreement Bolsters ‘Pivot to Asia’,” *The Diplomat* (<http://thediplomat.com>), April 29, 2014; “Philippines To Give U.S. Forces Access To Up To Five Military Bases,” *Reuters* (<http://www.reuters.com>), May 2, 2014; Carl Thayer, “Analyzing the US-Philippines Enhanced Defense Cooperation Agreement,” *The Diplomat* (<http://thediplomat.com>), May 2, 2014.

closer to the United States) operate some of its forces in the area of the U.S. Seventh Fleet (the fleet for the Western Pacific), which could essentially double the number of Navy command staffs available in the Western Pacific for coordinating simultaneous multiple U.S. contingency operations in that region.²²² In April, May, and June 2016, the Navy announced that it had begun doing this.²²³

In addition to the above actions, U.S. Marines began six-month rotational training deployments through Darwin, Australia, with the number of Marines in each deployment scheduled to increase to 2,500 by 2020 or later (a delay from an earlier target date of 2016).²²⁴

Acquisition Programs

As mentioned earlier (see “Limitations and Weaknesses” in “Background”), China’s navy exhibits limitations or weaknesses in several areas, including antisubmarine warfare (ASW). Countering China’s naval modernization might thus involve, among other things, actions to exploit such limitations and weaknesses, such as developing and procuring Virginia (SSN-774) class attack submarines, torpedoes, and unmanned underwater vehicles (UUVs).

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 highly capable ships now being acquired include Ford (CVN-78) class aircraft carriers,²²⁵ Virginia (SSN-774) class attack submarines,²²⁶ and Arleigh Burke (DDG-51) class Aegis destroyers.²²⁷

Examples of highly capable aircraft now being acquired by the Navy and Marine Corps include F-35C carrier-based Joint Strike Fighters (JSFs), F-35B STOVL (short takeoff, vertical landing) JSFs,²²⁸ F/A-18E/F Super Hornet strike fighters and EA-18G Growler electronic attack aircraft,²²⁹

²²² Tim Kelly, “U.S. Admiral Signals Wider Role for Powerful Third Fleet in Western Pacific,” *Reuters*, September 26, 2015.

²²³ See “USS Momsen Departs on Pacific Surface Action Group Deployment,” *Navy News Service*, April 18, 2016; Audrey McAvoy, “US Pacific Fleet Expands Use of 3rd Fleet Commanders,” *ABC News*, April 26, 2016; William Cole, “Navy Ships Will Answer To San Diego While In Asia,” *Honolulu Star Advertiser*, April 27, 2016; Mina Pollmann, “US Expands 3rd Fleet’s Role in the Western Pacific,” *The Diplomat*, May 11, 2016; Ken Moriyasu, “US to Counter China Uncertainty with Combined Pacific Fleet,” *Nikkei Asian Review*, June 14, 2016; Idrees Ali and David Brunnstrom, “U.S. Third Fleet Expands East Asia Role As Tensions Rise with China,” *Reuters*, June 15, 2016. See also Tim Kelly, “San Diego to South China Sea: U.S. Navy Tested New Command in Latest Challenge to China,” *Reuters*, October 25, 2016; Ryan Pickrell, “US Preps To Fight On Two Fronts In Asia,” *Daily Caller*, October 25, 2016; Carl Prine, “Navy’s Third Fleet Returns to World War II Roots,” *San Diego Union Tribune*, January 6, 2017; Carl Prine, “Navy’s Third Fleet Splashes Through the South China Sea,” *San Diego Union Tribune*, March 1, 2017.

²²⁴ See, for example, Matthew L. Schehl, “U.S., Australia Delay Plans to Send More marines Down Under,” *Marine Corps Times*, June 10, 2016; Seth Robson, “Expanded Marines Deployment to Australia Delayed,” *Military.com*, June 3, 2016.

²²⁵ For more on the CVN-78 program, see CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by (name redacted) .

²²⁶ For more on the Virginia-class program, see CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by (name redacted) .

²²⁷ For more on the DDG-51 program, including the planned Flight III version, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by (name redacted) .

²²⁸ For more on the F-35 program, see CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by (name redacted) .

²²⁹ For more on the F/A-18E/F and EA-18G programs, see CRS Report RL30624, *Navy F/A-18E/F and EA-18G Aircraft Program*, by (name redacted) .

E-2D Hawkeye early warning and command and control aircraft, and the P-8A Multi-mission Maritime Aircraft (MMA).

Examples of new weapon technologies that might be of value in countering Chinese maritime A2/AD capabilities include new and more capable versions of the Aegis ballistic missile defense (BMD) system,²³⁰ as well as solid state lasers (SSLs), the electromagnetic rail gun (EMRG), and a hypervelocity projectile (HPV) for the 5-inch guns on Navy cruisers and destroyers.²³¹

Training and Forward-Deployed Operations

The Navy in recent years has increased antisubmarine warfare (ASW) training for Pacific Fleet forces and conducted various forward-deployed operations in the Western Pacific, including exercises and engagement operations with Pacific allied and partner navies, as well as operations that appear to have been aimed at monitoring Chinese military operations.²³²

Increased Naval Cooperation with Allies and Other Countries

U.S. Navy forces in recent years have taken steps to increase cooperation with naval forces from allies and other countries, such as Japan, Australia, and India. Some of these efforts appear to involve 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 are sometimes discussed in connection with the term “Indo-Pacific,” a term that gained prominence in 2017 among U.S., Japanese, Australian, and Indian observers as a way of referring to the Indian and Pacific Ocean areas as one large, connected area.²³³

Issues for Congress

Future Size and Capability of U.S. Navy

One potential oversight issue for Congress, particularly in the context of the constraints on U.S. defense spending established by the Budget Control Act of 2011 as amended, is whether the U.S. Navy in coming years will be large enough and capable enough to adequately counter improved

²³⁰ For more on the Aegis BMD program, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by (name redacted) .

²³¹ For more on these new weapon technologies, see CRS Report R44175, *Navy Lasers, Railgun, and Hypervelocity Projectile: Background and Issues for Congress*, by (name redacted) .

²³² Incidents at sea in recent years between U.S. and Chinese ships and aircraft in China’s Exclusive Economic Zone (EEZ) appear to involve, on the U.S. side, ships and aircraft, such as TAGOS ocean surveillance ships and EP-3 electronic surveillance aircraft, whose primary apparent mission is to monitor foreign military operations.

²³³ See, for example, Ellen Barry, “U.S. Proposes Reviving Naval Coalition to Balance China’s Expansion,” *New York Times*, March 2, 2016; Andrew Davies and Mark Thomson, “Can ‘Quad Plus’ Flex Its Muscles Against China?” *National Interest*, March 8, 2016; Walter Lohman, “America’s Strategic Partnership with India Is About More Than Afghanistan,” *National Interest*, September 2, 2017; Victor D. Cha, “Powerplay: The Origins of the American Alliance System in Asia,” *National Interest*, September 7, 2017; Mir Sadat, “How India Can Help Make America Great Again,” *National Interest*, November 2, 2017; James Jay Carafano, “How America and Its Indo-Pacific Allies Will Redefine Regional Security,” *National Interest*, November 10, 2017; Zhiqun Zhu, “Is Indo-Pacific the ‘New’ Pivot?” *National Interest*, November 23, 2017. For more on the Indo-Pacific, see CRS Insight IN10888, *Australia, China, and the Indo-Pacific*, by (name redacted) CRS In Focus IF10726, *China-India Rivalry in the Indian Ocean*, by (name redacted) and CRS In Focus IF10199, *U.S.-Japan Relations*, coordinated by (name redacted) .

Chinese maritime A2/AD forces while also adequately performing other missions around the world of interest to U.S. policymakers. Some observers are concerned that a combination of growing Chinese naval capabilities and budget-driven limitations on the size and capability of the U.S. Navy could encourage Chinese military overconfidence, demoralize U.S. allies and partners in the Pacific, and destabilize or make it harder for the United States to defend its interests in the region.²³⁴

Current Navy plans, announced in December 2016, call for achieving and maintaining a fleet of 355 ships of various types and numbers.²³⁵ Many observers are concerned that constraints on Navy budgets in coming years will result in a fleet with considerably fewer than 355 ships—or a fleet with 355 ships but not enough new technology, weapons, and readiness. The issue of whether the U.S. Navy in coming years will be large enough and capable enough to adequately counter improved Chinese maritime A2/AD forces while also adequately performing other missions around the world of interest to U.S. policymakers is part of a larger debate about whether stated U.S. national defense strategy will be adequately resourced.

Long-Range Carrier-Based Aircraft and Long-Range Weapons

Another potential oversight issue for Congress is whether the Navy's plans for developing and procuring long-range carrier-based aircraft and long-range ship- and aircraft-launched weapons are appropriate and adequate. Aircraft and weapons with longer ranges could help Navy ships and their aircraft achieve substantial military effects while the ships remain outside the ranges of Chinese A2/AD systems that can pose a threat to their survivability—a stand-off capability that some observers deem important and believe the Navy currently lacks.²³⁶

MQ-25 Stingray (Previously UCLASS Aircraft)

Some observers have stressed a need for the Navy to proceed with its plans for developing and deploying a long-range, carrier-based, unmanned UAV, as one measure for extending the operational range of Navy carrier air wings. These observers view the acquisition of a long-range carrier-based UAV as key to maintaining the survivability and mission effectiveness of aircraft carriers against Chinese A2/AD systems in coming years.

Navy plans for doing this had centered on a program called the Unmanned Carrier Launched Airborne Surveillance and Strike (UCLASS) aircraft. The operational requirements for the UCLASS aircraft were a matter of some debate, with a key issue being whether the UCLASS should be optimized for penetrating heavily defended air space and conducting strike operations at long ranges, or for long-endurance intelligence, surveillance, and reconnaissance (ISR) operations (with a limited secondary capacity for conducting strike operations).²³⁷

²³⁴ See, for example, Audrey McAvoy, "US Pacific Fleet Shrinks Even as China Grows More Aggressive," *ABC News (Associated Press)*, January 5, 2016; Seth Cropsey, "S.O.S. for a Declining American Navy," *Wall Street Journal*, January 6, 2016.

²³⁵ For further discussion, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by (name redacted) .

²³⁶ For an article that provides an overview discussion of the issue, see Robert Haddick, "The Real U.S.-China War Asia Should Worry About: The 'Range War,'" *National Interest*, July 25, 2014. See also Anthony Capaccio, "U.S. Must Deploy Anti-Ship Missile in Asia, Admiral Says," *Bloomberg*, February 23, 2016; Megan Eckstein, "Harris: PACOM Needs More Subs, Long-Range Missiles To Counter Chinese Threats," *USNI News*, February 25, 2016.

²³⁷ See, for example, Dave Majumdar, "Requirements Debate Continues to Delay UCLASS RFP," *USNI News* (<http://news.usni.org>), March 24, 2014; Mike McCarthy, "NAVIAR Chief Says Navy Seeking Optimal Balance On (continued...)

The Navy subsequently restructured the UCLASS program into a new program, called the Unmanned Carrier Aviation (UCA)/MQ-25 Stingray program, for developing a carrier-based, unmanned tanker aircraft for conducting in-flight refueling of manned carrier-based aircraft. In its FY2019 budget submission, the Department of the Navy states that

The Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) program underwent a restructure with near term focus on the new Unmanned Carrier Aviation (UCA)/MQ-25 Stingray program and accelerating fielding timelines. The MQ-25 Stingray program rapidly develops an unmanned capability to embark on CVNs as part of the Carrier Air Wing (CVW) to conduct aerial refueling as a primary mission and provide some ISR capability as a secondary mission. MQ-25 Stingray extends CVW mission effectiveness range, partially mitigates the current Carrier Strike Group (CSG) organic ISR shortfall and fills the future CVW-tanker gap, mitigating Strike Fighter shortfall and preserving F/A-18E/F Fatigue Life. As the first carrier-based, group 5 Unmanned Aircraft System (UAS), MQ-25 Stingray will pioneer the integration of manned and unmanned operations, demonstrate mature complex sea-based C4I UAS technologies, and pave the way for future multifaceted multi-mission UAS to pace emergent threats. FY 2019 will leverage previous work completed under UCLASS, focusing on the three segment areas: air, control system and connectivity, and carrier development. MQ-25 Stingray is expected to provide an IOC [initial operational capability] to the fleet in FY 2026.²³⁸

The Department of the Navy also states the following:

Navy is committed to unmanned carrier aviation. MQ-25 Stingray will deliver the Navy's first carrier-based UAS to function primarily as a mission tanker to extend the range, reach, and lethality of the carrier air wing with secondary recovery tanking and ISR capabilities. MQ-25 will reduce current use of F/A-18E/Fs as carrier air wing tankers, freeing F/A-18E/Fs to execute strike fighter missions, effectively increasing strike fighter capacity within the carrier air wing. MQ-25 is a rapid acquisition program designed to significantly reduce its development and delivery timeline. The program has established a short chain of command to mitigate risk and expedite programmatic and technical trade decisions.²³⁹

Long-Range Anti-Ship and Land Attack Missiles

Some observers have stressed a need for the Navy to develop and field longer-ranged anti-ship and land-attack missiles, so that U.S. Navy ships would not be out-ranged by Chinese navy ships armed with long-range ASCMs, and so that U.S. Navy ships would be able to achieve substantial military effects while operating outside the ranges of other Chinese A2/AD weapons. The U.S. Navy now has a number of efforts underway to develop and field such weapons. Some of these efforts focusing on modifying existing weapons so as to achieve new capabilities in the near term; other efforts involve developing new-design, next-generation weapons that would be fielded in later years. In its FY2019 budget submission, the Department of the Navy states that it

(...continued)

UCLASS," *Defense Daily*, March 7, 2014.

²³⁸ Department of the Navy, *Highlights of the Department of the Navy FY 2019 Budget*, 2018, pp. 5-4 to 5-5.

²³⁹ Statement of the Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition ASN(RD&A), and Lieutenant General Robert S. Walsh, Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, and Vice Admiral William R. Merz, Deputy Chief of Naval Operations for Warfare Systems (OPNAV n9) before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Ccapabilities, March 6, 2018, p. 15.

has aligned its Cruise Missile Strategy along warfighter domains to pursue maximized lethality while minimizing overall costs to the taxpayer. The first tenet of our strategy is to sustain the highly successful, combat proven, Tomahawk cruise missile inventory through its anticipated service-life via a mid-life recertification program starting in the first quarter of FY 2019. This recertification program will increase missile service-life by an additional 15 years (total of 30 years) and enable the Department to support Tomahawk in our active inventory through the mid-late 2040s. In concert with our recertification program we will integrate modernization and technological upgrades and address existing obsolescence issues. In addition, we are developing a Maritime Strike Tomahawk capability to deliver a long-range anti-surface warfare capability.

The Department will field the Long-Range Anti-Ship Missile (LRASM) as the air-launched Offensive Anti-Surface Warfare/Increment 1 (OASuW/Inc[rement]. 1) material solution to meet near to mid-term anti-surface warfare threats. LRASM is pioneering accelerated acquisition processes. We anticipate LRASM will meet all Joint Chiefs of Staff-approved warfighting requirements, and deliver on-time within cost.

Finally, the Department plans to develop follow-on next generation strike capabilities such as the surface and submarine launched Next Generation Land Attack Weapon (NGLAW). NGLAW will have both a long-range land strike and maritime ASuW capability that initially complements, and then replaces, the highly successful Tomahawk Weapon System.²⁴⁰

Long-Range Air-to-Air Missile

Another potential issue for Congress is whether the Navy should develop and procure a long-range air-to-air missile for its carrier-based strike fighters. Such a weapon might improve the survivability of Navy carrier-based strike fighters in operations against Chinese aircraft armed with capable air-to-air missiles, and help permit Navy aircraft carriers to achieve results while remaining outside the ranges of Chinese A2/AD systems that can pose a threat to their survivability.

During the Cold War, Navy F-14 carrier-based fighters were equipped with a long-range air-to-air missile called the Phoenix. The F-14/Phoenix combination was viewed as key to the Navy's ability to effectively counter Soviet land-based strike aircraft equipped with long-range ASCMs that appeared designed to attack U.S. Navy aircraft carriers. A successor to the Phoenix called the Advanced Air-to-Air Missile (AAAM) was being developed in the late 1980s, but the AAAM program was cancelled as a result of the end of the Cold War. The Navy today does not have a long-range air-to-air missile, and DOD has announced no program to develop such a weapon.

A September 22, 2015, press report states the following:

Beyond visual range air-to-air missiles (BVRAAM) are long-range missiles used by fighters to knock out enemy fighters, bombers, tankers, drones and other aircraft from ranges beyond 30km. On September 15, 2015, China successfully test fired its latest iteration, the PL-15, firing from a fighter to destroy a target drone.

The PL-15 is developed by the 607 Institute. It is the replacement for China's current BVRAAM, the radar guided, PL-12, which reportedly has a range of approximately

²⁴⁰ Statement of the Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition ASN(RD&A), and Lieutenant General Robert S. Walsh, Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, and Vice Admiral William R. Merz, Deputy Chief of Naval Operations for Warfare Systems (OPNAV n9) before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Ccapabilities, March 6, 2018, p. 17.

100km. Compared to the PL-12, the PL-15 has an improved active radar seeker and jam-resistant datalinks, along with a dual pulse rocket motor to extend its range.

Even in the prototype stage, the PL-15 is already an international star. Speaking at the 2015 Air Force Association conference the same week as the test, USAF Air Combatant Commander General Hawk Carlisle cited the PL-15 as the reason for Congress to fund a new missile to replace the American AMRAAM. His reasons for concern is the PL-15's range. By incorporating a ramjet engine, its range could reach 150-200km, as well as its terminal maneuverability. That would out-range existing American air-to-air missiles, making the PL-15 not just a threat to fighters like the F-35, but also to US bombers and aerial tankers critical to American air operations across the vast Pacific. General Carlisle called "out-sticking" the PL-15 a high priority for the USAF.

As the PL-15 moves to deployment stage, it will equip Chinese stealth fighter jets, such as the J-20 and J-31, as well as the older J-10, J-11, J-15 and J-16 fighters. This makes keeping up with the PL-15 an important part of American efforts to out-do an innovative and improving Chinese military system.²⁴¹

A November 22, 2016, press report states the following:

In November 2016, a Chinese J-16 strike fighter test-fired a gigantic hypersonic missile, successfully destroying the target drone at a very long range.

Looking at takeoff photos, we estimate the missile is about 28 percent of the length of the J-16, which measures 22 meters (about 72 feet). The puts the missile at about 19 feet, and roughly 13 inches in diameter. The missile appears to have four tailfins. Reports are that the size would put into the category of a very long range air to air missile (VLRAAM) with ranges exceeding 300 km (roughly 186 miles), likely max out between 250 and 310 miles. (As a point of comparison, the smaller 13.8-foot, 15-inch-diameter Russian R-37 missile has a 249-mile range).

This is a big deal: this missile would easily outrange any American (or other NATO) air-to-air missile. Additionally, the VLRAAM's powerful rocket engine will push it to Mach 6 speeds, which will increase the no escape zone (NEZ), that is the area where a target cannot outrun the missile, against even supersonic targets like stealth fighters.

The new, larger missile's added value is not just in range. Another key feature: its large active electronically scanned (AESA) radar, which is used in the terminal phase of flight to lock onto the target. The AESA radar's large size—about 300-400% larger than that of most long range air-to-air missiles—and digital adaptability makes it highly effective against distant and stealthy targets, and resilient against electronic countermeasures like jamming and spoofing.

The VLRAAM's backup sensor is a infrared/electro-optical seeker that can identify and hone in on high-value targets like aerial tankers and airborne early warning and control (AEW&C) radar aircraft. The VLRAAM also uses lateral thrusters built into the rear for improving its terminal phase maneuverability when engaging agile targets like fighters....

The gains in range and speed of the VLRAAM pose another significant risk to the concepts of the U.S. military's "Third Offset." U.S. operations are highly dependent on assets like aerial tankers, dedicated electronic warfare aircraft, and AEW&C. For example, without aerial tankers, the relatively short range of the F-35s would become even more of a liability in long range operations in the South China Seas and Taiwan Straits. Similarly, without AEW&C aircraft, F-22s would have to use onboard radars more, raising their risk of detection. Even for stealthy tanker platforms like the planned

²⁴¹ Jeffrey Lin and P.W. Singer, "Chinese Air-To-Air Missile Hits Targets, Spooks USAF General," *Popular Science*, September 22, 2015.

MQ-25 Stingray drone and proposed KC-Z tanker will be vulnerable to VLRAAMs if detected by emerging dedicated anti-stealth systems such as the Divine Eagle drone and Yuanmeng airship.

By pushing the Chinese air defense threat bubble hundreds of miles out further, they also offer to turn the long range tables on the putative U.S. "Arsenal" Plane concept, a Pentagon plan to launch missiles from non-stealthy planes from afar. In sum, VLRAAM is not just a big missile, but a potential big deal for the future of air warfare.²⁴²

Navy's Ability to Counter China's ASBMs

Another potential oversight issue for Congress concerns the 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.

Breaking the ASBM's Kill Chain

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."²⁴³

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.²⁴⁴ The Navy could acquire weapons and systems

²⁴² Jeffrey Lin and P.W. Singer, "China Is Testing A New Long-Range, Air-To-Air Missile That Could Thwart U.S. Plans for Air Warfare," *Popular Science*, November 22, 2016. See also David Axe, "New Chinese Air-to-Air Missile Could Hit U.S. Jets Before They Can Shoot Back," *War Is Boring*, November 27, 2016; Ben Blanchard, "China May Be Developing New Long-Range Air-To-Air Missile," *Reuters*, January 26, 2017; Zhao Lei, "PLA May Have New Air-To-Air Missile," *China Daily*, January 26, 2017; Alex Lockie, "New Chinese Air-to-Air Missile Designed to Threaten US Air Force," *Scout Warrior*, January 30, 2017; "China Will Soon Have Airpower Rivaling the West's," *Economist*, February 15, 2018; Jason Blackstone, "It's Time to Arm the Navy's Super Hornet with the Ultimate Missile," *National Interest*, March 30, 2018.

²⁴³ David A. Fulghum, "USAF: Slash And Burn Defense Cuts Will Cost Missions, Capabilities," *Aerospace Daily & Defense Report*, September 30, 2011: 6.

²⁴⁴ 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 (continued...)

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 version), the SM-6 terminal-defense BMD interceptor missile,²⁴⁵ and accelerating development and deployment of the hypervelocity projectile (HVP), electromagnetic rail gun (EMRG), and solid state lasers (SSLs).²⁴⁶ 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.²⁴⁷

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

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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.

²⁴⁵ 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 (name redacted) .

²⁴⁶ For more on HVP, EMRG, and SSLs, see CRS Report R44175, *Navy Lasers, Railgun, and Hypervelocity Projectile: Background and Issues for Congress*, by (name redacted) .

²⁴⁷ 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.

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.

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."²⁴⁸

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?

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.²⁴⁹

Endo-Atmospheric Target for Simulating DF-21D ASBM

A December 2011 report from DOD's Director, Operational Test and Evaluation (DOT&E)—the DOT&E office's annual report for FY2011—stated the following in its section on test and evaluation resources:

Anti-Ship Ballistic Missile Target

A threat representative Anti-Ship Ballistic Missile (ASBM) target for operational open-air testing has become an immediate test resource need. China is fielding the DF-21D ASBM, which threatens U.S. and allied surface warships in the Western Pacific. While the Missile Defense Agency has exo-atmospheric targets in development, no program currently exists for an endo-atmospheric target. The endo-atmospheric ASBM target is the Navy's responsibility, but it is not currently budgeted. The Missile Defense Agency estimates the non-recurring expense to develop the exo-atmospheric target was \$30 million with each target costing an additional \$30 million; the endo-atmospheric target will be more expensive to produce according to missile defense analysts. Numerous Navy acquisition programs will require an ASBM surrogate in the coming years, although a limited number of targets (3-5) may be sufficient to validate analytical models.²⁵⁰

A February 28, 2012, press report stated the following:

“Numerous programs will require” a test missile to stand in for the Chinese DF-21D, “including self-defense systems used on our carriers and larger amphibious ships to counter anti-ship ballistic missiles,” [Michael Gilmore, the Pentagon's director of operational test and evaluation] said in an e-mailed statement....

“No Navy target program exists that adequately represents an anti-ship ballistic missile's trajectory,” Gilmore said in the e-mail. The Navy “has not budgeted for any study, development, acquisition or production” of a DF-21D target, he said.

²⁴⁸ 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.

²⁴⁹ 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.

²⁵⁰ Department of Defense, Director, Operational Test and Evaluation, *FY 2011 Annual Report*, December 2011, p. 294.

Lieutenant Alana Garas, a Navy spokeswoman, said in an e-mail that the service “acknowledges this is a valid concern and is assessing options to address it. We are unable to provide additional details.”...

Gilmore, the testing chief, said his office first warned the Navy and Pentagon officials in 2008 about the lack of an adequate target. The warnings continued through this year, when the testing office for the first time singled out the DF-21D in its annual public report....

The Navy “can test some, but not necessarily all, potential means of negating anti-ship ballistic missiles,” without a test target, Gilmore said.²⁵¹

The December 2012 report from DOT&E (i.e., DOT&E’s annual report for FY2012) did not further discuss this issue; a January 21, 2013, press report stated that this is because the details of the issue are classified.²⁵²

A December 16, 2016, press report about a December 14, 2016, flight test of the Navy’s Aegis ballistic missile defense system²⁵³ states the following:

The Missile Defense Agency (MDA) said its new Sea Based Terminal (SBT) system achieved its second ballistic missile intercept during a Dec. 14 test over the Pacific Ocean.

During the test, the USS John Paul Jones (DDG-53)... fired a salvo of two Raytheon [RTN] Standard Missile-6 (SM-6) interceptors in immediate succession against a medium-range ballistic missile target launched from the Pacific Missile Range Facility on Kauai, Hawaii. The first interceptor was not armed and was designed to collect test data, MDA said. The second interceptor, which carried an explosive warhead, intercepted the Lockheed Martin-built target....

MDA called the target “complex” but declined to elaborate. However, according to the Missile Defense Advocacy Alliance, the target emulated China’s Dong-Feng 21 (DF-21), a ballistic missile equipped with a maneuverable re-entry vehicle and designed to destroy U.S., aircraft carriers.

The event, designated Flight Test Standard Missile-27 (FTM-27), was SBT’s first salvo test and its second intercept in as many tries.²⁵⁴

Navy’s Ability to Counter China’s Submarines

Another potential oversight issue for Congress concerns the Navy’s ability to counter China’s submarines. Some observers raised questions about the Navy’s ability to counter Chinese submarines following an incident on October 26, 2006, when a Chinese Song-class submarine reportedly surfaced five miles away from the Japan-homeported U.S. Navy aircraft carrier *Kitty Hawk* (CV-63), which reportedly was operating at the time with its strike group in international

²⁵¹ Tony Capaccio, “Navy Lacks Targets To Test U.S. Defenses Against China Missile,” *Bloomberg Government* (bgov.com), February 28, 2012. See also Christopher J. Castelli, “DOD IG Questions Realism Of Targets Used To Simulate Enemy Missiles,” *Inside Missile Defense*, March 21, 2012.

²⁵² Christopher J. Castelli, “DOD Testing Chief Drops Public Discussion Of ASBM Target Shortfall,” *Inside the Navy*, January 21, 2013.

²⁵³ For more on the Navy’s Aegis BMD program, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by (name redacted) .

²⁵⁴ Marc Selinger, “Missile Defense Agency Scores Second Intercept With Sea Based Terminal System,” *Defense Daily*, December 16, 2016: 3-4.

waters in the East China Sea, near Okinawa.²⁵⁵ In November 2015, it was reported that during the weekend of October 24, 2015, a Chinese attack submarine closely trailed the U.S. Navy aircraft carrier *Ronald Reagan* (CVN-76) while it was steaming around the southern end of Japan toward the Sea of Japan; the event was reported to be the closest encounter between a Chinese submarine and a U.S. Navy aircraft carrier since 2006.²⁵⁶ In December 2015, it was reported that during the encounter, the submarine conducted a simulated missile attack on the carrier.²⁵⁷

Improving the Navy's ability to counter China's submarines could involve further increasing ASW training exercises,²⁵⁸ procuring platforms (i.e., ships and aircraft) with ASW capabilities, and/or developing technologies for achieving a new approach to ASW that is distributed and sensor-intensive (as opposed to platform-intensive).²⁵⁹ Countering wake-homing torpedoes more effectively could require completing development work on the Navy's new anti-torpedo torpedo (ATT) and putting the weapon into procurement. An August 30, 2016, press report states the following:

Enemy submarines remain the single most dangerous threat to the United States Navy's aircraft carriers and its surface fleet at large. However the service is working on improving its anti-submarine warfare (ASW) capabilities as the once-dormant Russian undersea force reemerges and China grows its fleet...

[Chief of Naval Operations John] Richardson said that the U.S. Navy is focusing more on ASW with a combination of air, sea and undersea forces. One way to ensure the safety of the U.S. Navy's surface fleet is to ensure that the service's attack submarine (SSN) force

²⁵⁵ Bill Gertz, "China Sub Secretly Stalked U.S. Fleet," *Washington Times*, November 13, 2006: 13; Philip Creed, "Navy Confirms Chinese Sub Spotted Near Carrier," *NavyTimes.com*, November 13, 2006; Bill Gertz, "Defenses On [sic] Subs To Be Reviewed," *Washington Times*, November 14, 2006; En-Lai Yeoh, "Fallon Confirms Chinese Stalked Carrier," *NavyTimes.com*, November 14, 2006; Bill Gertz, "Admiral Says Sub Risked A Shootout," *Washington Times*, November 15, 2006; Jeff Schogol, "Admiral Disputes Report That Kitty Hawk, Chinese Sub Could Have Clashed," *Mideast Starts and Stripes*, November 17, 2006.

²⁵⁶ Bill Gertz, "Chinese Submarine Stalked U.S. Aircraft Carrier," *Washington Free Beacon*, November 3, 2015; Franz-Stefan Gady, "Closest Encounter Since 2006: Chinese Submarines Tailed US Aircraft Carrier," *The Diplomat*, November 4, 2015.

²⁵⁷ Bill Gertz, "Chinese Submarine Practiced Missile Attack on USS Reagan," *Washington Free Beacon*, December 15, 2015.

²⁵⁸ For a press report of one such exercise, see David S. Cloud, "Aboard A U.S. Nuclear Sub, A Cat-and-Mouse Game with Phantom Foes," *Los Angeles Times*, September 25, 2015.

²⁵⁹ Navy officials in 2004-2005 spoke of their plans for achieving distributed, sensor-intensive ASW architecture. (See Otto Kreisher, "As Underwater Threat Re-Emerges, Navy Renews Emphasis On ASW," *Seapower*, October 2004, p. 15, and Jason Ma, "ASW Concept Of Operations Sees 'Sensor-Rich' Way Of Fighting Subs," *Inside the Navy*, February 7, 2005.) Such an approach might involve the use of networked sensor fields, unmanned vehicles, and standoff weapons. (See Jason Ma, "Autonomous ASW Sensor Field Seen As High-Risk Technical Hurdle," *Inside the Navy*, June 6, 2005. See also Jason Ma, "Navy's Surface Warfare Chief Cites Progress In ASW Development," *Inside the Navy*, January 17, 2005. More recent press reports discuss research on ASW concepts involving bottom-based sensors, sensor networks, and unmanned vehicles; see Richard Scott, "GLINT In the Eye: NURC Explores Novel Autonomous Concepts For Future ASW," *Jane's International Defence Review*, January 2010: 34-35; Richard Scott, "DARPA Goes Deep With ASW Sensor Network," *Jane's International Defence Review*, March 2010: 13; Richard Scott, "Ghost In The Machine: DARPA Sets Course Towards Future Unmanned ASW Trail Ship," *Jane's Navy International*, April 2010: 10-11; Norman Friedman, "The Robots Arrive," *Naval Forces*, No. IV, 2010: 40-42, 44, 46; Bill Sweetman, "Darpa Funds Unmanned Boat For Submarine Stalking," *Aerospace Daily & Defense Report*, January 6, 2011: 5; Richard Scott, "Networked Concepts Look to Square the ASW Circle," *Jane's International Defence Review*, January 2011: 42-47; Richard Scott, "DARPA's Unmanned ASW Sloop Concept Casts Lines," *Jane's Navy International*, January/February 2011: 5.) See also Jeremy Page, "Underwater Drones Join Microphones to Listen for Chinese Nuclear Submarines," *Wall Street Journal*, October 24, 2014; Richard Scott, "Nodes, Networks And Autonomy: Charting A Course For Future ASW," *Jane's International Defence Review*, December 2014: 47-51; "Japan, U.S. Running Undersea Listening Post to Detect Chinese Subs," *Japan Times*, September 10, 2015.

remains dominant in the undersea realm. “We spend a lot of time on that dynamic,” said Richardson, who spent most of his long naval career onboard nuclear-powered submarines. “One is for our own submarines, we want to make sure they can get into those really influential places and stay there—and part of staying there is being stealthy enough to remain hidden and keep that undersea superiority we have.”

But increasingly, for the first time since the 1991 collapse of the Soviet Union, the U.S. Navy finds itself challenged under the waves. “There is an awful lot of competition for that space,” Richardson said. “So we can’t get complacent, we can’t rest on our laurels for one minute, otherwise that window will close and we’ll find—that they’ve achieved parity undersea. So we’ve got to continue to push and also to develop our own anti-submarine warfare systems—which is an area of really big emphasis.”...

“In terms of just a capacity challenge, the Chinese are building a lot of submarines,” Richardson said. “Some of them—at least from a quietness standpoint, it’s going to take some time to find them—they’re diesels, they’re [equipped with] AIP [air-independent propulsion systems]—those sorts of things. They’re just inherently quiet... it’s just something that’s going to take a while to achieve because you have to find them and get to them. And then quantity has a quality of its own.”²⁶⁰

Navy’s Fleet Architecture

Some observers, viewing China’s maritime anti-access/area-denial (A2/AD) forces, have raised the question of whether the U.S. Navy should respond by shifting over time to a more highly distributed fleet architecture featuring a reduced reliance on aircraft carriers and other large ships and an increased reliance on smaller ships. The question of whether the U.S. Navy concentrates too much of its combat capability in a relatively small number of high-value units, and whether it should shift over time to a more highly distributed fleet architecture, has been debated at various times over the years, in various contexts.

Supporters of shifting to a more highly distributed fleet architecture argue that the Navy’s current architecture, including its force of 11 large aircraft carriers, in effect puts too many of the Navy’s combat-capability eggs into a relatively small number of baskets on which an adversary can concentrate its surveillance and targeting systems and its anti-ship weapons. They argue that although a large Navy aircraft carrier can absorb hits from multiple conventional weapons without sinking, a smaller number of enemy weapons might cause damage sufficient to stop the carrier’s aviation operations, thus eliminating the ship’s primary combat capability and providing the attacker with what is known as a “mission kill.” A more highly distributed fleet architecture, they argue, would make it more difficult for China to target the Navy and reduce the possibility of the Navy experiencing a significant reduction in combat capability due to the loss in battle of a relatively small number of high-value units.

Opponents of shifting to a more highly distributed fleet architecture argue that large carriers and other large ships are not only more capable, but proportionately more capable, than smaller ships, that larger ships are capable of fielding highly capable systems for defending themselves, and that they are much better able than smaller ships to withstand the effects of enemy weapons, due to their larger size, extensive armoring and interior compartmentalization, and extensive damage-control systems. A more highly distributed fleet architecture, they argue, would be less capable or more expensive than today’s fleet architecture. Opponents of shifting to a more highly distributed fleet architecture could also argue that the Navy has already taken important steps toward fielding

²⁶⁰ Dave Majumdar, “Chief of Naval Operations Richardson: US Navy is Focusing on Enemy Submarine Threat,” *National Interest*, August 30, 2016.

a more distributed fleet architecture through its plan to acquire 40 LCSs and 12 JHSVs, and through the surface fleet's recently announced concept of distributed lethality, under which offensive weapons are to be distributed more widely across all types of Navy surface ships and new operational concepts for Navy surface ship formations are to be implemented.²⁶¹

The Navy's future fleet architecture is discussed further in another CRS report.²⁶²

Legislative Activity for FY2019

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 China's naval modernization effort, among other things. 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 (name redacted)
- CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by (name redacted)
- CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by (name redacted) (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 (name redacted)
- CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by (name redacted)
- CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by (name redacted)
- CRS Report R44175, *Navy Lasers, Railgun, and Hypervelocity Projectile: Background and Issues for Congress*, by (name redacted)

²⁶¹ Navy surface fleet leaders announced the distributed lethality concept in early 2015. The aim of distributed lethality is to boost the surface fleet's capability for attacking enemy ships and make it less possible for an enemy to cripple the U.S. fleet by concentrating its attacks on a few very-high-value Navy surface ships (particularly the Navy's aircraft carriers). See Thomas Rowden, Peter Gumataotao, and Peter Fanta, "Distributed Lethality," *U.S. Naval Institute Proceedings*, January 2015: 18-23; Sam LaGrone, "SNA: Navy Surface Leaders Pitch More Lethal Ships, Surface Action Groups," *USNI News*, January 14, 2015; Kris Osborn, "Navy Unveils New Surface Warfare Strategy," *Military.com*, January 14, 2015; Sydney J. Freedberg Jr., "'If It Floats, It Fights,': Navy Seeks 'Distributed Lethality,'" *Breaking Defense*, January 14, 2015; Mike McCarthy and Megan Eckstein, "Navy Eyeing A 'Hunter Killer' Surface Fleet, Would Require Uppunning Existing Ship Fleets," *Defense Daily*, January 15, 2015: 1-3; Richard Scott, "Offensive Language: USN Sets Out Surface Firepower Strategy," *Jane's International Defence Review*, May 2015: 42-47; Megan Eckstein, "Navy Studying Implications of Distributed Lethality in Wargames Series," *USNI News*, July 9, 2015; Lara Seligman, "Navy Establishes Task Force To Study Impact of Distributed lethality," *Inside the Navy*, July 10, 2015.

²⁶² See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by (name redacted) .

FY2019 National Defense Authorization Act (H.R. 5515)

House

In H.R. 5515 as reported by the House Armed Services Committee (H.Rept. 115-676 of May 15, 2018), **Section 1242** states:

SEC. 1252. United States strategy on China.

(a) Findings.—Congress finds the following:

(1) The United States has a national strategic interest in ensuring that the United States maintains political, diplomatic, economic, military, and technological advantages over competitive adversaries.

(2) The 2018 National Defense Strategy states that “the central challenge to the U.S. prosperity and security is the reemergence of long-term, strategic competition by what the National Security Strategy classifies as revisionist powers. It is increasingly clear that China and Russia want to shape a world consistent with their authoritarian model—gaining veto authority over other nations’ economic, diplomatic, and security decisions”.

(3) The 2018 National Defense Strategy further states that “China is leveraging military modernization, influence operations, and predatory economics to coerce neighboring countries to reorder the Indo-Pacific region to their advantage. As China continues its economic and military ascendance, asserting power through an all-of-nation long term strategy, it will continue to pursue a military modernization program that seeks Indo-Pacific regional hegemony in the near-term and displacement of the United States to achieve global preeminence in the future”.

(4) Statements by officials of the United States and leading experts have emphasized that the United States requires a whole-of-government response, across the full spectrum of capabilities, to address the challenges posed by China.

(b) Statement of policy.—Congress declares that long-term strategic competition with China is a principal priority for the United States that requires the integration of multiple elements of national power, including diplomatic, economic, intelligence, law enforcement, and military elements, to protect and strengthen national security.

(c) Strategy required.—

(1) IN GENERAL.—Not later than March 1, 2019, the President shall submit to the appropriate congressional committees a report containing a whole-of-government strategy with respect to the People’s Republic of China.

(2) ELEMENTS OF STRATEGY.—The strategy required by paragraph (1) shall include the following:

(A) Strategic assessments of and planned responses to address the following activities by the Chinese Communist Party:

(i) The use of political influence, information operations, censorship, and propaganda to undermine democratic institutions and processes, and the freedoms of speech, expression, press, and academic thought.

(ii) The use of intelligence networks to exploit open research and development.

(iii) The use of economic tools, including market access and investment to gain access to sensitive United States industries.

(iv) Malicious cyber activities.

(v) The use of investment, infrastructure, and development projects, such as China’s Belt and Road Initiative, in Africa, Europe, Central Asia, South America, and the Indo-Pacific region, and the Polar Silk Road in the Arctic, as a means to gain access and influence.

(vi) The use of military activities, capabilities, and defense installations, and hybrid warfare methods, short of traditional armed conflict, against the United States or its allies and partners.

(B) Available or planned methods to enhance strategic communication to counter Chinese influence and promote United States interests.

(C) An identification of the key diplomatic, development, intelligence, military, and economic resources necessary to implement the strategy.

(D) A plan to maximize the coordination and effectiveness of such resources to counter the threats posed by the activities described in subparagraph (A).

(E) Available or planned interagency mechanisms for the coordination and implementation of the strategy.

(3) FORM.—The report required by paragraph (1) shall be submitted in unclassified form, but may include a classified annex.

(4) ANNUAL BUDGET SUBMISSION.—The President shall ensure that the annual budget submitted to Congress pursuant to section 1105 of title 31, United States Code clearly highlights the programs and projects proposed to be funded that relate to the strategy required by paragraph (1).

(5) APPROPRIATE CONGRESSIONAL COMMITTEES.—In this section, the term “appropriate congressional committees” means—

(A) the Committee on Armed Services, the Committee on Foreign Relations, the Select Committee on Intelligence, the Committee on Finance, the Committee on Homeland Security and Governmental Affairs, the Committee on the Judiciary, the Committee on Commerce, Science, and Transportation, and the Committee on the Budget of the Senate; and

(B) the Committee on Armed Services, the Committee on Foreign Affairs, the Permanent Select Committee on Intelligence, the Committee on Financial Services, the Committee on Homeland Security, the Committee on the Judiciary, the Committee on Energy and Commerce, and the Committee on the Budget of the House of Representatives.

Section 1261 of H.R. 5515 as reported by the committee states:

SEC. 1261. Report and public notification on China’s military, maritime, and air activities in the Indo-Pacific region.

(a) Sense of Congress.—It is the sense of Congress that greater transparency of China’s provocative military, maritime, and air activities in the Indo-Pacific region would—

- (1) aid in raising awareness of these activities in regional and international forums;
- (2) enable regional security partners to more effectively protect their sovereignty and defend their rights under international law; and
- (3) maintain stability within the region to enable constructive relations with China.

(b) Report.—

(1) IN GENERAL.—The Secretary of Defense, in consultation with the Director of National Intelligence and the Secretary of State, shall submit to the appropriate congressional committees on a quarterly basis a report describing China’s provocative military, maritime, and air activities in the Indo-Pacific region.

(2) ELEMENTS.—The report shall, at minimum, address China’s provocative military, maritime, and air activities, military deployments, and operations and infrastructure construction in the East China Sea, South China Sea, Taiwan Strait, and Indian Ocean.

(3) DISSEMINATION TO REGIONAL ALLIES.—The report shall be disseminated to regional allies and partners, as appropriate, in the Indo-Pacific region.

(4) IMAGERY AND SUPPORTING ANALYSIS.—The report may include imagery from military aircraft and other sources with supporting analysis to describe China’s provocative maritime and air activities.

(5) FORM.—The report shall be available to the public and shall be submitted or carried out in unclassified form.

(c) Public notification.—

(1) IN GENERAL.—The Secretary of Defense, in consultation with the Director of National Intelligence and the Secretary of State, shall provide notice to the public of any activities described in paragraph (2) immediately after the initiation of any such activities.

(2) ACTIVITIES DESCRIBED.—The activities described in this paragraph are any significant destabilizing or deceptive activities of China, including reclamation or militarization activity in the Indo-Pacific region, use of military, government, or commercial aircraft or maritime vessels to intimidate regional neighbors.

(3) WRITTEN SUMMARY.—As soon as practicable after the notification to the public under paragraph (1) of any activities described in paragraph (2), the Secretary of Defense shall distribute to the appropriate congressional committees and United States allies and security partners in the Indo-Pacific region a written summary to include imagery and supporting analysis describing such activities.

(d) Requirements relating to national security and protection of classified national security information.—The dissemination and availability of the report under subsection (b) and the notification to the public under subsection (c) shall be made in a manner consistent with national security and the protection of classified national security information.

(e) Appropriate congressional committees defined.—In this section, the term “appropriate congressional committees” means—

(1) the congressional defense committees; and

(2) the Committee on Foreign Relations and the Select Committee on Intelligence of the Senate and the Committee on Foreign Affairs and the Permanent Select Committee on Intelligence of the House of Representatives.

H.Rept. 115-676 states:

Long-range naval carrier aviation

The committee notes that section 1067 of the National Defense Authorization Act for Fiscal Year 2016 (Public Law 114–92) directed the Secretary of Defense to provide three independent studies of alternative future fleet platform architectures for the Navy in the 2030 timeframe.

The committee further notes that the three studies concur as to the need for an enhanced carrier-based unmanned long-range strike capability beyond current plans and programs. The committee remains concerned that while the MQ–25 program leverages Unmanned Carrier-Launched Airborne Surveillance and Strike requirements justification, the most recent documentation sent to industry did not include precision strike capability as a requirement. The committee believes that the Navy may be unnecessarily excluding a

critical capability and precluding future growth in a platform that will likely be integrated into the carrier air wing for the next 30 years.

Therefore, the committee encourages the Navy to develop an unmanned anti-access penetrating long-range strike capability from the aircraft carrier, in addition to the current focus on the MQ-25A. (Page 15)

H.Rept. 115-676 also states:

Surface ship torpedo defense

The evolving challenges and tensions in the Indo-Asia-Pacific region underscore the ongoing requirement for a surface ship torpedo defense (SSTD) capability for the Navy's high-value units. The committee understands that the Chief of Naval Operations highlighted this requirement in a 2010 urgent operational need statement and that since that time, potential regional adversaries have continued to improve their submarine and torpedo capabilities. Despite this increasing threat to Navy carrier strike groups and surface platforms, and the continued SSTD testing success and program maturation, the budget request and the Future Years Defense Program inadequately support currently deployed systems and cancel further development of this SSTD capability.

The committee is concerned that this decision is based on the need to balance several years of inadequate funding resources across a range of priorities and that this budgetary dynamic is forcing decisions that put at risk the readiness and security of U.S. naval and Marine forces without adequate alternative plans to mitigate that threat. As raised in previous communications with Navy officials, the committee also has concerns that the Navy has distributed various SSTD program responsibilities among various Navy resource sponsors, which has led to a lack of determined support for efficient program execution and a lack of focused leadership.

In light of these concerns, the committee directs the Secretary of the Navy to provide a briefing to the House Committee on Armed Services by October 1, 2018, that includes, but is not limited to, the following: an assessment of the current and foreseeable torpedo threats facing high-value units and the Navy's plan to adequately protect them, a description of the requirements for SSTD, an assessment of the development program concerning each of the SSTD capability elements, the plan to consolidate responsibility of the SSTD program, and the plan to manage and sustain currently fielded SSTD systems. (Page 19)

H.Rept. 115-676 also states:

Briefing for the Senate Committee on Armed Services and the House

Committee on Armed Services on US Navy's efforts to expand carrier air wing long-range strike capability The committee notes that the aircraft carrier air wing has been optimized for striking power and sortie generation and believes that it may not be configured to support the long-range strike required by current and future threat systems. While the introduction of the F-35C will significantly expand stealth capabilities, the F-35C could require increased range to address necessary targets. The committee believes that several options could be used to address this issue to include developing a stealth tanker capability, improved engine technology or to develop and procure a strike capability that is purposely built to strike at increased range. The committee further notes that the Navy previously desired to significantly increase the carrier air wing range with the development of the A-12 aircraft. The committee understands that the A-12 would have included a 5,000-pound internal carriage payload, stealth, and a range of 800 nautical miles. While the committee believes that requirements to support this capability remain relevant and the technology available, the development of the A-12 aircraft was mired in acquisition challenges that eventually resulted in the cancellation of the program. While the committee further believes that the Department of Defense has

successfully developed a suite of long-range intelligence, surveillance and reconnaissance capabilities, the committee also believes that it is vital that the Navy develop a carrier-based long-range strike capability.

Therefore, the committee directs the Secretary of the Navy to provide a briefing to the Senate Committee on Armed Services and the House Committee on Armed Services by January 25, 2019, on options to expand the strike range of a carrier air wing in a contested environment, including manned and unmanned capabilities, and, Department of the Navy capabilities it plans to pursue in the Next Generation Air Dominance capability. (Page 46)

H.Rept. 115-676 also states:

MQ-25 Unmanned Carrier Aviation program

The budget request contained \$718.9 million for the MQ-25 Unmanned Carrier Aviation program.

The committee supports the Navy's efforts to develop and field a carrier-based unmanned aerial system to provide refueling as well as intelligence, surveillance, and reconnaissance support to the fleet. The committee notes that the Chief of Naval Operations intends to accelerate this program by 2 years in order to provide this capability by 2026. To date, the Navy has provided insufficient air vehicle justification. Budget documents state that \$598.78 million will go to Air Segment Primary Hardware Development with very little further justification or cost estimates.

The committee recommends a decrease of \$116.9 million, for a total of \$602.0 million, to procure one test article for the MQ-25 Unmanned Carrier Aviation program. (Pages 50-51)

Appendix A. Strategic and Budgetary Context

This appendix provides an overview of the strategic and budgetary context in which China's naval modernization effort and its implications for U.S. Navy capabilities may be considered. There is also a broader context of U.S.-China relations and U.S. foreign policy toward the Asia-Pacific that is covered in other CRS reports.²⁶³

Shift in International Security Environment

World events have led some observers, starting in late 2013, to conclude that the international security environment has undergone a shift from the familiar post-Cold War era of the past 20 to 25 years, also sometimes known as the unipolar moment (with the United States as the unipolar power), to a new and different situation that features, among other things, renewed great power competition with China and Russia and challenges by these two countries and others to elements of the U.S.-led international order that has operated since World War II.²⁶⁴ China's improving naval capabilities can be viewed as one reflection of that shift.

Uncertainty Regarding Future U.S. Role in the World

The overall U.S. role in the world since the end of World War II in 1945 (i.e., over the past 70 years) is generally described as one of global leadership and significant engagement in international affairs. A key aim of that role has been to promote and defend the open international order that the United States, with the support of its allies, created in the years after World War II. In addition to promoting and defending the open international order, the overall U.S. role is generally described as having been one of promoting freedom, democracy, and human rights, while criticizing and resisting authoritarianism where possible, and opposing the emergence of regional hegemony in Eurasia or a spheres-of-influence world.

Certain statements and actions from the Trump Administration have led to uncertainty about the Administration's intentions regarding the future U.S. role in the world. Based on those statements and actions, some observers have speculated that the Trump Administration may want to change the U.S. role in one or more ways. A change in the overall U.S. role could have profound implications for U.S. defense strategy, plans, and programs, including those relating to countering improved Chinese naval capabilities.²⁶⁵

U.S. Grand Strategy

The above-mentioned shift in the international security environment and uncertainty over the future U.S. role in the world has led to a renewed emphasis in discussions of U.S. security and foreign policy on grand strategy and geopolitics. From a U.S. perspective, grand strategy can be understood as strategy considered at a global or interregional level, as opposed to strategies for specific countries, regions, or issues. Geopolitics refers to the influence on international relations

²⁶³ See, for example, CRS Report R41108, *U.S.-China Relations: An Overview of Policy Issues*, by (name redacted) , and CRS Report R42448, *Pivot to the Pacific? The Obama Administration's "Rebalancing" Toward Asia*, coordinated by (name redacted) .

²⁶⁴ For additional discussion, see CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by (name redacted) .

²⁶⁵ For additional discussion, see CRS Report R44891, *U.S. Role in the World: Background and Issues for Congress*, by (name redacted) and (name redacted) .

and strategy of basic world geographic features such as the size and location of continents, oceans, and individual countries.

From a U.S. perspective on grand strategy and geopolitics, it can be noted that most of the world's people, resources, and economic activity are located not in the Western Hemisphere, but in the other hemisphere, particularly Eurasia. In response to this basic feature of world geography, U.S. policymakers for the past several decades have chosen to pursue, as a key element of U.S. national strategy, a goal of preventing the emergence of a regional hegemon in one part of Eurasia or another, on the grounds that such a hegemon could represent a concentration of power strong enough to threaten core U.S. interests by, for example, denying the United States access to some of the other hemisphere's resources and economic activity. Although U.S. policymakers have not often stated this key national strategic goal explicitly in public, U.S. military (and diplomatic) operations in recent decades—both wartime operations and day-to-day operations—can be viewed as having been carried out in no small part in support of this key goal. Some observers view China's military (including naval) modernization effort as part of broader Chinese effort to become a regional hegemon in its part of Eurasia.

U.S. Strategic Rebalancing to Asia-Pacific Region

A 2012 DOD strategic guidance document²⁶⁶ and DOD's report on the 2014 Quadrennial Defense Review (QDR)²⁶⁷ state that U.S. military strategy will place an increased emphasis on the Asia-Pacific region. Although Obama Administration officials stated that this U.S. strategic rebalancing toward the Asia-Pacific region, as it is called, is not directed at any single country, many observers believe it is in no small part intended as a response to China's military (including naval) modernization effort and its assertive behavior regarding its maritime territorial claims.

Declining U.S. Technological and Qualitative Edge

DOD officials have expressed concern that the technological and qualitative edge that U.S. military forces have had relative to the military forces of other countries is being narrowed by improving military capabilities in other countries. China's improving naval capabilities contribute to that concern.

Challenge to U.S. Sea Control and U.S. Position in Western Pacific

Observers of Chinese and U.S. military forces view China's improving naval capabilities as posing a challenge in the Western Pacific to the U.S. Navy's ability to achieve and maintain control of blue-water ocean areas in wartime—the first such challenge the U.S. Navy has faced since the end of the Cold War.²⁶⁸ More broadly, these observers view China's naval capabilities as a key element of a broader Chinese military challenge to the long-standing status of the United States as the leading military power in the Western Pacific.

²⁶⁶ Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense*, January 2012, 8 pp. For additional discussion, see CRS Report R42146, *Assessing the January 2012 Defense Strategic Guidance (DSG): In Brief*, by (name redacted) and (name redacted)

²⁶⁷ Department of Defense, *Quadrennial Defense Review 2014*, 64 pp. For additional discussion, see CRS Report R43403, *The 2014 Quadrennial Defense Review (QDR) and Defense Strategy: Issues for Congress*, by (name redacted)

²⁶⁸ The term "blue-water ocean areas" is used here to mean waters that are away from shore, as opposed to near-shore (i.e., littoral) waters. Iran is viewed as posing a challenge to the U.S. Navy's ability to quickly achieve and maintain sea control in littoral waters in and near the Strait of Hormuz. For additional discussion, see CRS Report R42335, *Iran's Threat to the Strait of Hormuz*, coordinated by (name redacted)

Implications of Military Balance in Absence of a Conflict

Some observers consider a U.S.-Chinese military conflict in the Pacific over Taiwan or some other issue to be very unlikely because of significant U.S.-Chinese economic linkages and the tremendous damage that such a conflict could cause on both sides. In the absence of such a conflict, the U.S.-Chinese military balance in the Pacific could nevertheless influence day-to-day choices made by other Pacific countries on whether to align their policies more closely with China or the United States. In this sense, decisions that Congress and the executive branch make regarding U.S. Navy programs for countering improved Chinese maritime military forces could influence the political evolution of the Pacific and consequently the ability of the United States to pursue various policy goals.

China's "Salami-Slicing" Tactics in East and South China Seas

China's actions for asserting and defending its maritime territorial and exclusive economic zone (EEZ)²⁶⁹ claims in the East China Sea (ECS) and South China Sea (SCS), particularly since late 2013, have heightened concerns among observers that ongoing disputes over these waters and some of the islands within them could lead to a crisis or conflict between China and a neighboring country, and that the United States could be drawn into such a crisis or conflict as a result of obligations the United States has under bilateral security treaties with Japan and the Philippines. More broadly, China's actions for asserting and defending its maritime territorial and EEZ claims, including recent land reclamation and construction activities at several sites in the SCS, have led to increasing concerns among some observers that China is seeking to dominate or gain control of its near-seas region. Some observers characterize China's approach for asserting and defending its territorial claims in the ECS and SCS as a "salami-slicing" strategy that employs a series of incremental actions, none of which by itself is a *casus belli*, to gradually change the status quo in China's favor.²⁷⁰

Regional U.S. Allies and Partners

The United States has certain security-related policies pertaining to Taiwan under the Taiwan Relations Act (H.R. 2479/P.L. 96-8 of April 10, 1979). The United States has bilateral security treaties with Japan, South Korea, the Philippines, and an additional security treaty with Australia and New Zealand.²⁷¹ In addition to U.S. treaty allies, certain other countries in the Western Pacific can be viewed as current or emerging U.S. security partners.

²⁶⁹ A country's EEZ includes waters extending up to 200 nautical miles from its land territory. Coastal states have the right under the United Nations Convention on the Law of the Sea (UNCLOS) to regulate foreign economic activities in their own EEZs. EEZs were established as a feature of international law by UNCLOS.

²⁷⁰ For further discussion, see CRS Report R42784, *Maritime Territorial and Exclusive Economic Zone (EEZ) Disputes Involving China: Issues for Congress*, by (name redacted) ; CRS Report R42930, *Maritime Territorial Disputes in East Asia: Issues for Congress*, by (name redacted), (name redacted), and (name redacted) and CRS Report R44072, *Chinese Land Reclamation in the South China Sea: Implications and Policy Options*, by (name redacted) et al.

²⁷¹ For a summary, see "U.S. Collective Defense Arrangements," accessed July 24, 2015, at <http://www.state.gov/s/l/treaty/collectivedefense/>.

Limits on Defense Spending in Budget Control Act of 2011 as Amended

Limits on the “base” portion of the U.S. defense budget established by Budget Control Act of 2011, or BCA (S. 365/P.L. 112-25 of August 2, 2011), as amended, combined with some of the considerations above, have led to discussions among observers about how to balance competing demands for finite U.S. defense funds, and about whether programs for responding to China’s military modernization effort can be adequately funded while also adequately funding other defense-spending priorities, such as initiatives for responding to Russia’s actions in Ukraine and elsewhere in Europe and U.S. operations for countering the Islamic State organization in the Middle East. U.S. Navy officials have stated that if defense spending remains constrained to levels set forth in the BCA as amended, the Navy in coming years will not be able to fully execute all the missions assigned to it under the 2012 DOD strategic guidance document.²⁷²

²⁷² See, for example, Statement of Admiral Jonathan Greenert, U.S. navy, Chief of Naval Operations, Before the Senate Armed Services Committee on the Impact of Sequestration on National Defense, January 28, 2015, particularly page 4 and Table 1, entitled “Mission Impacts to a Sequestered Navy.”

Appendix B. 2014 ONI Testimony on China's Navy

This appendix presents the prepared statement of Jesse L. Karotkin, ONI's Senior Intelligence Officer for China, for a January 30, 2014, hearing before the U.S.-China Economic and Security Review Commission on China's military modernization and its implications for the United States. The text of the statement is as follows:

TRENDS IN CHINA'S NAVAL MODERNIZATION

US CHINA ECONOMIC AND SECURITY REVIEW COMMISSION

TESTIMONY

JESSE L. KAROTKIN

Introduction

At the dawn of the 21st Century, the People's Liberation Army Navy (PLA(N)) remained largely a littoral force. Though China's maritime interests were rapidly changing, the vast majority of its naval platforms offered very limited capability and endurance, particularly in blue water. Over the past 15 years the PLA(N) has carried out an ambitious modernization effort, resulting in a more technologically advanced and flexible force. This transformation is evident not only the PLA(N)'s Gulf of Aden counter-piracy presence, which is now in its sixth year, but also in the navy's more advanced regional operations and exercises. In contrast to its narrow focus a just decade ago, the PLA(N) is evolving to meet a wide range of missions including conflict with Taiwan, enforcement of maritime claims, protection of economic interests, as well as counter-piracy and humanitarian missions.

The PLA(N) currently possesses approximately 77 principal surface combatants, more than 60 submarines, 55 medium and large amphibious ships, and roughly 85 missile-equipped small combatants. Although overall order-of-battle has remained relatively constant in recent years, the PLA(N) is rapidly retiring legacy combatants in favor of larger, multi-mission ships, equipped with advanced anti-ship, anti-air, and anti-submarine weapons and sensors. During 2013 alone, over fifty naval ships were laid down, launched, or commissioned, with a similar number expected in 2014. Major qualitative improvements are occurring within naval aviation and the submarine force, which are increasingly capable of striking targets hundreds of miles from the Chinese mainland.

The introduction of long-range anti-ship cruise missiles across the force, coupled with non-PLA(N) weapons such as the DF-21D anti-ship ballistic missile, and the requisite C4ISR architecture to support targeting, will allow China to significantly expand its "counter-intervention" capability further into the Philippine Sea and South China Sea over the next decade. Many of these capabilities are designed specifically to deter or prevent U.S. military intervention in the region.

Even if order-of-battle numbers remain relatively constant through 2020, the PLA(N) will possess far more combat capability due to the rapid rate of acquisition coupled with improving operational proficiency. Beijing characterizes its military modernization effort as a "three-step development strategy" that entails laying a "solid foundation" by 2010, making "major progress" by 2020, and being able to win "informationized wars by the mid-21st century." Although the PLA(N) faces capability gaps in some key areas, including deep-water anti-submarine warfare and joint operations, they have achieved their "strong foundation" and are emerging as a well equipped, competent, and more professional force.

A Multi-Mission Force

As China began devoting greater resources to naval modernization in the late 1990s, virtually all of its ships, submarines were essentially single-mission platforms, poorly equipped to operate beyond the support of land-based defenses. The PLA(N) has subsequently acquired larger, multi-mission platforms, capable of long-distance deployments and offshore operations. China's latest Defense White Paper, released in 2013, noted that the PLA(N) "endeavors to accelerate the modernization of its forces for comprehensive offshore operations... [and] develop blue water capabilities." The LUYANG III-class DDG (052D), which will likely enter service this year, embodies the trend towards a more flexible force with advanced air defenses and long-range strike capability.

China has made the most demonstrable progress in anti-surface warfare (ASuW), deploying advanced, long-range ASCMs throughout the force. With the support from improved C4ISR, this investment significantly expands the area that surface ships, submarines, and aircraft are able to hold at risk. The PLA(N) has also made notable gains in anti-air warfare (AAW), enabling the recent expansion of blue-water operations. Just over a decade ago, just 20 percent of PLA(N) combatants were equipped with a rudimentary point air defense capability. As a result, the surface force was effectively tethered to the shore. Initially relying on Russian surface to air missiles (SAMs) to address this gap, newer PLA(N) combatants are equipped with indigenous medium-to-long range area air defense missiles, modern combat management systems, and air-surveillance sensors.

Although progress in anti-submarine warfare (ASW) is less pronounced, there are indications that the PLA(N) is committed to addressing this gap. More surface platforms are being equipped with modern sonar systems, to include towed arrays and hangars to support shipboard helicopters. Additionally, China appears to be developing a Y-8 naval variant that is equipped with a magnetic anomaly detector (MAD) boom, typical of ASW aircraft. Over the next decade, China is likely to make gains in ASW, both from improved sensors and operator proficiency.

China's submarine force remains concentrated almost exclusively on ASuW, with exception of the JIN SSBN, which will likely commence deterrent patrols in 2014. The type-095 guided missile attack submarine, which China will likely construct over the next decade, may be equipped with a land-attack capability. The deployment of LACMs on future submarines and surface combatants could enhance China's ability to strike key U.S. bases throughout the region, including Guam.

Naval aviation is also expanding its mission set and capability in maritime strike, maritime patrols, anti-submarine warfare, airborne early warning, and logistics. Although it will be several years before the *Liaoning* aircraft carrier and its air wing can be considered fully operational, this development signals a new chapter in Chinese naval aviation. By 2020, carrier-based aircraft will be able to support fleet operations in a limited air-defense role. Although some older air platforms remain in the inventory, the PLA(N) is clearly shifting to a naval aviation force that is equipped to execute a wide variety of missions both near and far from home.

PLA(N) Surface Force

China analysts face a perpetual challenge over how to accurately convey the size and capability of China's surface force. As U.S. Navy CAPT Dale Rielage noted in [the U.S. Naval Institute] *Proceedings* last year, key differences in the type of PLA(N) ships (in comparison to the U.S. Navy) make it extremely difficult to apply a common basis for comparing the order of battle. A comprehensive tally of ships that includes hundreds of small patrol craft, mine warfare craft, and coastal auxiliaries provides a deceptively inflated picture of China's actual combat capability. Conversely, a metric based on ship displacement returns the opposite effect, given the fact that many of China's modern

ships, such as the 1,500 ton JIANGDAO FFL, are small by U.S. standards, and equipped primarily for regional missions.

To accurately capture potential impact of China's naval modernization, it is necessary to provide a more detailed examination of the ships and capabilities in relation to the missions they are likely intended to fulfill. For the sake of clarity, the term "modern" is used in this paper to describe a surface combatant that possesses a multi-mission capability, incorporates more than a point air defense capability, and has the ability to embark a helicopter. As of early 2014, the PLA(N) possesses 27 destroyers (17 of which are modern), 48 frigates (31 of which are modern), 10 new corvettes, 85 modern missile-armed patrol craft, 56 amphibious ships, 42 mine warfare ships, over 50 major auxiliary ships, and over 400 minor auxiliary ships and service/support craft.

During the 1990s, China began addressing immediate capability gaps by importing modern surface combatants, weapon systems, and sensors from Russia. Never intended as a long-term solution, the PLA(N) simultaneously sought to design and produce its own weapons and platforms from a mix of imported and domestic technology. Less than a decade ago China's surface force could be characterized as an eclectic mix of vintage, modern, converted, imported, and domestic platforms utilizing a variety weapons and sensors and with widely ranging capabilities and varying reliability. By the second decade of the 2000s, surface ship acquisition had shifted entirely to Chinese designed units, equipped primarily with Chinese weapons and sensors, though some engineering components and subsystems remain imported or license-produced in-country.

Until recently, China tended to build small numbers of a large variety of ships, often changing classes rapidly as advancements were made. In the period between 1995 and 2005 alone, China constructed or purchased major surface combatants and submarines in at least different 15 classes. Using a combination of imported technology, reverse engineering, and indigenous development, the PRC has rapidly narrowed the technology and capability gap between itself and the world's modern navies. Additionally, China is implementing much longer production runs of advanced surface combatants and conventional submarines, suggesting a greater satisfaction in their recent ship designs.

The PLA(N) surface force has made particularly strong gains in anti-surface warfare (ASuW), with sustained development of advanced anti-ship cruise missiles (ASCMs) and over-the-horizon targeting systems. Most PLA(N) combatants carry variants of the YJ-8A ASCM (~65-120nm), while the LUYANG II-class (052D) destroyer is fitted with the YJ-62 (~120nm), and the newest class, LUYANG III-class destroyer is fitted with a new vertically-launched ASCM. As these extended range weapons require sophisticated over-the-horizon-targeting (OTH-T) capability to realize their full potential, China has invested heavily in maritime reconnaissance systems at the national and tactical levels, as well as communication systems and datalinks to enable the flow of accurate and timely targeting data.

In addition to extended range ASCMs, the LUYANG III DDG, which is expected to enter the force in 2014, may also be equipped with advanced SAMs, anti-submarine missiles, and possibly an eventual land-attack cruise missile (LACM) from its multipurpose vertical launch system. These modern, high-end combatants will likely provide increased weapons stores and overall flexibility as surface action groups venture more frequently into blue water in the coming years.

Further enabling this trend, China's surface force has achieved sustained progress in shipboard air defense. The PLA(N) is retiring legacy destroyers and frigates that possess at most a point air defense capability, while constructing newer ships with medium-to-long range area air defense missiles. The PLA(N) has produced a total of six LUYANG II DDG with the HHQ-9 surface-to-air missile (~55nm), and the LUYANG III DDG will carry an extended-range variant of the HHQ-9. At least fifteen JIANGKAI II FFGs (054A), with the vertically-launched HHQ-16 (~20-40nm) are now operational, with

more under construction. Sometimes referred to as the “workhorse” of the PLA(N) these modern frigates have proven instrumental in sustaining China’s counter-piracy presence in the Gulf of Aden.

The new generation of destroyers and frigates utilize modern combat management systems and air-surveillance sensors, such as the Chinese SEA EAGLE and DRAGON EYE phased-array radars. While older platforms with little or no air defense capability remain in the inventory, the addition of these newer units allows the PLA(N)’s surface force to operate with increased confidence outside of shore-based air defense systems, as one or two ships can now provide air defense for the entire task group. Currently, approximately 65 percent of China’s destroyers and frigates are modern. By 2020 that figure will rise to an estimated 85 percent.

The PLA(N) has also phased out hundreds of Cold War-era missile patrol boats and patrol craft as they shifted from a coastal defense orientation to a more active, offshore orientation over the past two decades. During this period China acquired a modern coastal-defense and area-denial capability with 60 HOUBEI class guided missile patrol boats. The HOUBEI design integrates a high-speed wave-piercing catamaran hull, waterjet propulsion, considerable signature-reduction features, and the YJ-8A ASCM. While not equipped for coastal patrol duties, the HOUBEI is an essential component of the PLA(N)’s ability to react at short notice to threats within China’s exclusive economic zone (EEZ) and slightly beyond.

In 2012 China began producing the new JIANGDAO class corvette (FFL), which, in contrast to the HOUBEI, is optimized to serve as the primary naval patrol platform in China’s EEZ and potentially defend China’s territorial claims in the South China Sea (SCS) and East China Sea (ECS). The 1500-ton JIANGDAO is equipped for littoral warfare with 76mm, 30mm, and 12.7mm guns, four YJ-8 ASCMs, torpedo tubes, and a helicopter landing area. The JIANGDAO is ideally-suited for general medium-endurance patrols, counter-piracy, and other littoral duties in regional waters, but is not sufficiently armed or equipped for major combat operations in blue-water. At least ten JIANGDAOs are already operational and thirty or more units may be built, replacing both older small patrol craft as well as some of the PLA(N)’s aging JIANGHU I frigates. The rapid construction of JIANGDAO FFLs accounts for a significant share of ship construction in 2012 and 2013.

In recent years, China’s amphibious acquisition has shifted decisively towards larger, high-end, ships. Since 2007 China has commissioned three YUZHAO class amphibious transport docks (LPD), which provide a considerably greater capacity and flexibility compared to previous landing ships. At 20,000 tons, the YUZHAO is the largest domestically produced Chinese warship and has deployed as far as the Gulf of Aden. The YUZHAO can carry up to four of the new air cushion landing craft YUYI LCUA (similar to LCAC), as well as four or more helicopters, armored vehicles, and troops on long-distance deployments. Additional YUZHAOs are expected to be built, as well as a follow-on amphibious assault ship (LHA) design that is larger and with a full-deck flight deck for additional helicopters.

The major investment in a large-deck LPD signaled the PLA(N)’s emerging interest in expeditionary warfare and over-the horizon amphibious assault capability, as well as a flexible platform for humanitarian assistance/disaster relief (HA/DR) and counter-piracy capabilities. In contrast, the PLA(N) appears to have suspended all construction of lower-end tank landing ships (LST/LSM) since 2006, following a spate of acquisition in the early 2000s.

The expanded set of missions further into the western Pacific and Indian Ocean, including counter-piracy deployments, HA/DR missions, survey voyages and goodwill port visits have increased demands on PLA(N)’s limited fleet of ocean-going replenishment and service vessels. In 2013 the PLA(N) added two new FUCHI

replenishment oilers (AORs) bringing the total AOR force level to seven ships. These ships constantly rotate in support of Gulf of Aden (GOA) counter-piracy deployments.

In addition, the PLA(N) recently added three state-of-the-art DALAO submarine rescue ships (ASR) and three DASAN fast-response rescue ships (ARS). Other recent additions include the ANWEI hospital ship (AH), the DANYAO AF (island resupply), YUAN WANG 5&6 (satellite and rocket launch telemetry), three KANHAI AG (SWATH-hull survey ships), two YUAN WANG 21 missile tenders (AEM), and the large DAGUAN AG, which provides berthing and logistical support to the KUZNETSOV aircraft carrier *Liaoning*.

Traditionally, anti-submarine warfare (ASW) has lagged behind ASuW and AAW as a priority for the PLA(N). Some moderate progress still continues, with more surface ships possessing modern sonars, to include towed arrays, as well as hangars to support shipboard helicopters. Given these developments, the PLA(N) surface force may be more capable of identifying adversary submarines in limited areas by 2020.

Over the past decade, China's surface force has made steady proficiency gains and become much more operationally focused. Beginning in 2009, the Gulf of Aden deployments have provided naval commanders and crews with their first real experience with extended deployments and overseas logistics. We have also witnessed an increase in the complexity of training and exercises and an expansion of operating areas both within and beyond the First Island Chain. To increase realism, the force engages in opposing force training and employs advanced training aids. In 2012 the surface force conducted an unprecedented seven deployments to the Philippine Sea. This was followed by nine Philippine Sea deployments in 2013. Extended surface deployments and more advanced training build core warfare proficiency in ASuW, ASW and AAW. Furthermore, these deployments reflect efforts to "normalize" distant seas training in line with General Staff Department (GSD) guidelines.

China's Aircraft Carrier Program

With spectacular ceremony in September 2012, China commissioned its first carrier, the *Liaoning*. China is currently engaged in the long and complicated path of learning to operate fixed wing aircraft from the carrier's deck. The first launches and recoveries of the J-15 aircraft occurred in November 2012, with additional testing and training occurring in 2013. Despite recent progress, it will take several years before Chinese carrier-based air regiments are operational. The PLA's newspaper, *Jiefangjun Bao* recently noted, "Aircraft Carrier development is core to the PLA(N), and could serve as a deterrent to countries who provoke trouble at sea, against the backdrop of the U.S. pivot to Asia and growing territorial disputes in the South China Sea and East China Sea."

The *Liaoning* is much less capable of power projection than the U.S. Navy's NIMITZ-class carriers. Not only does *Liaoning's* smaller size limit the total number of aircraft it can carry, but also the ski-jump configuration significantly limits aircraft fuel and ordnance load for take offs. Furthermore, China does not yet possess specialized supporting aircraft such as the E-2C Hawkeye, which provides tactical airborne early warning (AEW). The *Liaoning* is suited for fleet air defense missions, rather than US-style, long range power projection. Although it has a full suite of weapons and combat systems, *Liaoning's* primary role for the coming years will be to develop the skills required for carrier aviation and to train its first groups of pilots and deck crews.

China's initial carrier air regiment will consist of the Shenyang J-15 *Flying Shark*, which is externally similar to the Russian Su-33 *Flanker D*. However, the aircraft is thought to possess many of the domestic avionics and armament capabilities of the Chinese J-11B *Flanker*. Likely armament for the J-15 includes PL-8 and PL-12 air-to-air missiles and modern ASCMs. Six J-15 prototypes are currently involved in testing and at least one two-seat J-15S operational trainer has been observed.

China is fully aware of the inherent limitations of the mid-sized, ski-jump carrier. While Beijing has provided no public information on the size and configuration of its next carrier, there is intense speculation that China may adopt a catapult launching system. Recent media reports suggest that China recently commenced construction of its first indigenously produced carrier.

Finally, as China expands carrier operations beyond the immediate region, it will almost certainly be constrained by a lack of distant bases and support infrastructure. Although commercial ports can provide some peacetime support, Beijing may eventually find it expedient to abandon its longstanding, self-imposed prohibition on foreign basing.

PLA(N) Submarine Force

China has long regarded its submarine force as a critical element of regional deterrence, particularly when conducting “counter-intervention” against modern adversary. The large, but poorly equipped force of the 1980s has given way to a more modern submarine force, optimized primarily for regional anti-surface warfare missions near major sea lines of communication. Currently, the submarine force consists of five nuclear attack submarines, four nuclear ballistic missile submarines, and 53 diesel attack submarines.

In reference to the submarine force, the term “modern” applies to second generation submarines, capable of employing anti-ship cruise missiles or submarine-launched intercontinental ballistic missiles. By 2015 approximately 70 percent of China’s entire submarine force will be modern. By 2020, 75 percent of the conventional force will be modern and 100 percent of the SSN force will be modern.

Currently, most of the force is conventionally powered, without towed arrays, but equipped with increasingly long range ASCMs. Submarine launched ASCMs with ranges well in excess of 100nm not only enhance survivability of the shooter, but also enable a small number of units to hold a large maritime area at risk. A decade ago, only a few of China’s submarines were equipped to launch a modern anti-ship cruise missile. Given the rapid pace of acquisition, well over half of China’s nuclear and conventional attack submarines are now ASCM equipped, and by 2020, the vast majority of China’s submarine force will be armed with advanced, long-range ASCMs.

China’s small nuclear attack submarine force is capable of operating further from the Chinese mainland, conducting intelligence, surveillance and reconnaissance (ISR), as well as ASuW missions. Currently, China’s submarines are not optimized for either anti-submarine warfare or land attack missions.

Like the surface force, China’s submarine force is trending towards a more streamlined mix of units, suggesting the PLA(N) is relatively satisfied with recent designs. For its diesel-electric force alone, between 2000 and 2005, China constructed MING SS, SONG SS, the first YUAN SSP, and purchased 8 KILO SS from Russia. While all of these classes remain in the force, only the YUAN SSP is currently in production. Reducing the number of different classes in service helps streamline maintenance, training and interoperability.

The YUAN SSP is China’s most modern conventionally powered submarine. Eight are currently in service, with as many as 12 more anticipated. Its combat capability is similar to the SONG SS, as both are capable of launching Chinese-built anti-ship cruise missiles, but the YUAN SSP also possesses an air independent power (AIP) system and may have incorporated quieting technology from the Russian-designed KILO SS. The AIP system provides a submarine a source of power other than battery or diesel engines while still submerged, increasing its underwater endurance, thereby reducing its vulnerability to detection.

The remainder of the conventional submarine force is a mix of SONG SS, MING SS, and Russian-built KILO SS. Of these, only the MING SS and four of the older KILO SS lack

an ability to launch ASCMs. Eight of China's 12 KILO SS are equipped with the SS-N-27 ASCM, which provides a long-range anti-surface capability out to approximately 120nm. Although China's indigenous YJ-82 ASCM has a much shorter range, trends in surface and air-launched cruise missiles suggest that a future indigenous submarine-launched ASCM will almost certainly match or exceed the range of the SS-N-27.

China is now modernizing its relatively small nuclear-powered attack submarine force, following a protracted hiatus. The SHANG SSN's initial production run stopped after just two launches in 2002 and 2003. After nearly 10 years, China resumed production with four additional hulls of an improved variant, the first of which was launched in 2012. These six submarines will replace the aging HAN SSN on nearly a 1-for-1 basis over the next several years. Following the completion of the improved SHANG SSN, the PLA(N) will likely progress to the Type 095 SSN, which may provide a generational improvement in many areas such as quieting and weapon capacity, to include a possible land-attack capability.

Perhaps the most anticipated development in China's submarine force is the expected operational deployment of the JIN SSBN in 2014, which would mark China's first credible at-sea second-strike nuclear capability. With a range in excess of 4000nm, the JL-2 submarine launched ballistic missile (SLBM), will enable the JIN to strike Hawaii, Alaska, and possibly western portions of CONUS from East Asian waters. The three JIN SSBNs currently in service would be insufficient to maintain a constant at-sea presence for extended periods of time, but if the PLA Navy builds five units as some sources suggest, a continuous peacetime presence may become a viable option for the PLA(N).

Historically, the vast majority of Chinese submarine operations have been limited in duration. In recent years however, leadership emphasis on more realistic training and operational proficiency across the PLA appears to have catalyzed an increase in submarine patrol activity. Prior to 2008, the PLA(N) typically conducted a very small number of extended submarine patrols, typically fewer than 5 or 6 in a given year. Since that time, it has become common to see more than 12 patrols in a given year. This trend suggests the PLA(N) seeks to build operational proficiency, endurance, and training in ways that more accurately simulate combat missions.

PLA(N) Air Forces

The capabilities and role of the PLANAF have steadily evolved over the past decade. As navy combatants range further from shore and more effectively provide their own air defense, the PLANAF is able to concentrate on an expanded array of missions, including maritime strike, maritime patrols, anti-submarine warfare, airborne early warning, and logistics. Both helicopters and fixed wing aircraft will play an important role in enabling fleet operations over the next decade. Additionally, in the next few years the PLANAF will possess its first-ever sea-based component, with the *Liaoning* CV [aircraft carrier].

Every major PLA(N) surface combatant currently under construction is capable of embarking a helicopter, increasing platform capabilities in areas such as over the horizon targeting, anti-submarine warfare, and search and rescue (SAR). The PLA(N) operates three main helicopter variants: the Z-9, the Z-8, and the *Helix*. In order to keep pace with the rest of the PLA(N), the helicopter fleet will almost certainly expand in the near future.

The PLA(N)'s primary helicopter, the Z-9C, was originally obtained under licensed production from Aerospatiale (now Eurocopter) in the early 1980s. The Z-9C is capable of operating from any helicopter-capable PLA(N) combatant. It can be fitted with the KLC-1 search radar, dipping sonar, and is usually seen with a single lightweight torpedo. A new roof-mounted electro-optical (EO) turret, unguided rockets, and 12.7 mm machine gun pods have been observed on several Z-9Cs during counter piracy deployments. There are now approximately twenty operational Z-9Cs in the PLA(N) inventory and the

helicopters are still under production. An upgraded naval version of the Z-9, designated the Z-9D, has been observed with ASCMs.

Like the Z-9, the Z-8 is a Chinese-produced helicopter based on a French design. In the late 1970s, the PLA(N) purchased and reverse engineered the SA 321 Super Frelon. This medium lift helicopter is capable of performing a wide variety of missions but is most often utilized for SAR, troop transport, and logistical support roles. It is usually observed with a rescue hoist and a nose radome and typically operates unarmed. The Z-8's size provides a greater cargo capacity compared to other PLA(N) helicopters, but is limited in its ability to deploy from most PLA(N) combatants. An AEW variant of the Z-8 has been observed operating with the *Liaoning*.

In 1999, the PLA(N) took delivery of an initial batch of eight Russian-built Ka-28 *Helix* helicopters. The PLA(N) typically uses the Ka-28 for ASW. They are fitted with a search radar, dipping sonar and can employ sonobuoys, torpedoes, depth charges, or mines. In 2010 China also ordered nine Ka-31 *Helix* AEW helicopters.

Fixed-wing Aircraft

Over the last two decades, the PLANAF has significantly upgraded its fighters and expanded the type of aircraft it operates. As a consequence, it can successfully perform a wide range of missions including offshore air defense, maritime strike, maritime patrol/antisubmarine warfare, and in the not too distant future, carrier-based operations. A decade ago, this modernization was largely reliant on exports from Russia, however, the PLANAF has recently benefited from the same domestic combat aircraft production that has propelled earlier PLAAF modernization.

Historically, the PLA(N) relied on older Chengdu J-7 variants and Shenyang J-8B/D *Finback* fighters for the offshore air defense mission. These aircraft were limited in range, avionics, and armament. The J-8 is perhaps best known in the West as the aircraft that collided with a U.S. Navy EP-3 reconnaissance aircraft in 2001. In 2002, the PLA(N) purchased 24 Su-30MK2, making it the first 4th generation fighter fielded with the navy. These aircraft feature an extended range and maritime radar systems, enabling the Su-30MK2 to strike enemy ships at long distances, while still maintaining a robust air-to-air capability.

Several years later, the PLA(N) began replacing older J-8B/Ds with the newer J-8F variant. The J-8F featured improved armament such as the PL-12 radar-guided air-to-air missile, upgraded avionics, and an improved engine with higher thrust. Today, the PLA(N) is taking deliveries of modern domestically produced 4th generation fighter aircraft such as the J-10A *Vigorous Dragon* and the J-11B *Flanker*. Equipped with modern radars, glass cockpits, and armed with PL-8 and PL-12 air-to-air missiles, PLA(N) J-10A and J-11B aircraft are among the most modern aircraft in China's inventory.

For maritime strike, the PLA(N) has relied on the H-6 *Badger* for decades. The H-6 is a licensed copy of the ex-Soviet Tu-16 *Badger*, which can employ advanced ASCMs against surface targets. As many as 30 *Badgers* likely remain in service with the PLA(N). Despite the older platform design, Chinese H-6 *Badgers* benefit from upgraded electronics and payloads. Noted improvements include the ability to carry a maximum of four ASCMs, compared with two on earlier H-6D variants. Some H-6s have been modified as tankers, increasing the PLA(N)'s flexibility and range. The JH-7 *Flounder*, with at least five regiments fielded across the three fleets also provides a maritime strike capability. The JH-7 is a domestically produced tandem-seat fighter/bomber, developed as a replacement for obsolete Q-5 *Fantan* light attack aircraft and H-5 *Beagle* bombers. The JH-7 can carry up to four ASCMs and two PL-5 or PL-8 short-range air-to-air missiles, providing it with considerable payload for maritime strike missions.

In addition to combat aircraft, the PLANAF is expanding its inventory of fixed-wing Maritime Patrol Aircraft (MPA), Airborne Early Warning (AEW), and surveillance aircraft. The Y-8, a Chinese license-produced version of the ex-Soviet An-12 *Cub*, forms the basic airframe for several PLA(N) special mission variants. As the navy pushes farther from the coast, long-range aircraft play a key role in providing a clear picture of surface and air contacts in the maritime environment.

Internet photos from 2012 suggest that the PLA(N) is also developing a Y-8 naval variant, equipped with a MAD (magnetic anomaly detector) boom, typical of ASW aircraft. This ASW aircraft features a large surface search radar mounted under the nose and multiple blade antennae on the fuselage for probable electronic surveillance. It also appears to incorporate a small EO/IR turret and an internal weapons bay forward of the main landing gear. The aircraft appeared in a primer yellow paint scheme, suggesting that it remains under development.

Unmanned Aerial Vehicles

In recent years China has developed several multi-mission UAVs for the maritime environment. There are some indications the PLA(N) has begun to integrate UAVs into their operations to enhance situational awareness. For well over a decade, China has actively pursued UAV technology and they are emerging among the worldwide leaders in UAV development. China's latest achievement was the unveiling of their first prototype unmanned combat aerial vehicle (UCAV), the *Lijan*, which features a blended-wing design as well as low observable technologies.

The PLA(N) will probably employ significant numbers of land and ship based UAVs to supplement manned ISR aircraft and aid targeting for various long-range weapons systems. UAVs will probably become one of the PLA(N)'s most valuable ISR assets in on-going and future maritime disputes and protection of maritime claims. UAVs are ideally suited for this mission set due to their long loiter time, slow cruising speed, and ability to provide near real-time information through the use of a variety of onboard sensors. The PLA(N) has been identified operating the Austrian Camcopter S-100 rotary-wing UAV from several combatants. Following initial evaluation and deployment of the Camcopter S-100, the PLA(N) will likely adopt a domestically produced UAV into ship-based operations.

Naval Mines

China has a robust mining capability and currently maintains a varied inventory estimated at over 50,000 mines. China also has developed a robust infrastructure for naval mine related research, development, testing, evaluation, and production. During the past few years China has gone from an obsolete mine inventory, consisting primarily of pre-WWII vintage moored contact and basic bottom influence mines, to a robust mine inventory consisting of a large variety of mine types including moored, bottom, drifting, rocket propelled and intelligent mines. China will continue to develop more advanced mines in the future, possibly including extended-range propelled-warhead mines, anti-helicopter mines, and bottom influence mines equipped to counter minesweeping efforts.

Maritime C4ISR (Command, Control, Computers, Communication, Intelligence Surveillance and Reconnaissance)

China's steady expansion of naval missions beyond the littoral, including counter-intervention missions are enabled by a dramatic improvement in maritime C4ISR over the past decade. The ranges of China's modern anti-ship cruise missiles extend well beyond the range of a ship's own sensors. Emerging land-based weapons, such as the DF-21D anti-ship ballistic missile, with a range of more than 810nm are even more dependent on remote targeting. Modern navies depend heavily on their ability to build and disseminate a picture of all activities occurring in the air and sea.

For China, this provides a formidable challenge. In order to characterize activities in the “near seas,” China must build a maritime and air picture covering nearly 875,000 square nautical miles (sqnm). The Philippine Sea, which could become a key interdiction area in a regional conflict, expands the battlespace by another 1.5 million sqnm. In this vast space, many navies and coast guards converge along with tens of thousands of fishing boats, cargo ships, oil tankers, and other commercial vessels.

In order to sort through this complex environment and enable more sophisticated operations, China has invested in a wide array of sensors. Direct reporting from Chinese ships and aircraft provides the most detailed and reliable information, but can only cover a fraction of the regional environment. A number of ground-based coastal radars provide overlapping coverage of coastal areas, but their range is limited.

To gain a broader view of activity in its near and far seas, China requires more sophisticated sensors. The skywave over-the-horizon radar provides awareness of a much larger area than conventional radars by bouncing signals off the ionosphere. China also operates a growing array of reconnaissance satellites, which allow observation of maritime activity virtually anywhere on the earth.

Conclusion

The PLA(N) is strengthening its ability to execute a range of regional missions in a “complex electromagnetic environment” as it simultaneously lays a foundation for sustained, blue water operations. Over the next decade, China will complete its transition from a coastal navy to a navy capable of multiple missions around the world. Current acquisition patterns, training, and operations provide a window into how the PLA(N) might pursue these objectives.

Given the pace of PLA(N) modernization, the gap in military capability between the mainland and Taiwan will continue to widen in China’s favor over the coming years. The PRC views reunification with Taiwan as an immutable, long-term goal and hopes to prevent any other actor from intervening in a Taiwan scenario. While Taiwan remains a top-tier priority, the PLA(N) is simultaneously focusing resources on a growing array of potential challenges.

China’s interests in the East and South China Seas include protecting its vast maritime claims and preserving access to regional resources. Beijing prefers to use diplomacy and economic influence to protect maritime sovereignty, and generally relies on patrols by the recently-consolidated China Coast Guard. However, ensuring maritime sovereignty will remain a fundamental mission for the PLA(N). PLA(N) assets regularly patrol in most of China’s claimed territory to conduct surveillance and provide a security guarantee to China’s Coast Guard.

In the event of a crisis, the PLA(N) has a variety of options to defend its claimed territorial sovereignty and maritime interests. The PLA(N) could lead an amphibious campaign to seize key disputed island features, or conduct blockade or SLOC interdiction campaigns to secure strategic operating areas. China’s realization of an operational aircraft carrier in the coming years may also enable Beijing to exert greater pressure on its SCS rivals. Recent acquisitions speak to a future in which the PLA(N) will be expected to perform a wide variety of tasks including assuring the nation’s economic lifelines, asserting China’s regional territorial interests, conducting humanitarian assistance and disaster relief, and demonstrating a Chinese presence beyond region waters.²⁷³

²⁷³ [Hearing on] Trends in China’s Naval Modernization [before] U.S. China Economic and Security Review Commission[,] Testimony [of] Jesse L. Karotkin, [Senior Intelligence Officer for China, Office of Naval Intelligence, January 30, 2014], accessed February 12, 2014, 12 pp., at <http://www.uscc.gov/sites/default/files/> (continued...)

Appendix C. Joint Concept for Access and Maneuver in Global Commons (JAM-GC)

This appendix provides additional background information Joint Concept for Access and Maneuver in the Global Commons (JAM-GC), previously known as Air-Sea Battle (ASB).

October 10, 2013, Hearing

On October 10, 2013, the Seapower and Projection Forces subcommittee of the House Armed Services Committee held a hearing with several DOD officials as the witnesses that focused to a large degree on the Air-Sea Battle concept.²⁷⁴ One of the witnesses—Rear Admiral Upper Half James G. Foggo III, Assistant Deputy Chief of Naval Operations (Operations, Plans and Strategy) (N3/N5B)—provided the following overview of ASB in his opening remarks:

So let me begin by answering the question, what is the AirSea Battle concept? The AirSea Battle concept was approved by the Secretary of Defense in 2011. It is designed to assure access to parts of the global commons, those areas of the AirSea, Cyberspace, and Space that no one necessarily owns but which we all depend on such as sea lines of communication.

Our adversaries' Anti-Access/Area Denial strategies employ a range of military capabilities that impede the free use of these ungoverned spaces. These military capabilities include new generations of cruise, ballistic, air to air, surface to air missiles with improved range, accuracy and lethality that are being produced and proliferated.

Quiet, modern submarines and stealthy fighter aircraft are being procured by many nations while naval mines are being equipped with mobility, discrimination and autonomy. Both space and cyberspace are becoming increasingly important and contested.

Accordingly, AirSea Battle in its concept is intended to defeat such threats to access and provide options to national leaders and military commanders to enable follow-on operations which could include military activities as well as humanitarian assistance and disaster response. In short, it is a new approach to warfare.

The AirSea Battle concept is also about force development in the face of rising technological challenges. We seek to build at the service level a pre-integrated joint force which empowers U.S. combatant commanders, along with allies and partners to engage in ways that are cooperative and networked across multiple domains—the land, maritime, air, space and cyber domains.

And our goal includes continually refining and institutionalizing these practices. When implemented, the AirSea Battle concept will create and codify synergies within and among our services that will enhance our collective war fighting capability and effectiveness.

So that's, in a nutshell, what the AirSea Battle concept is. But now, what is it not? Sir, you pointed out the AirSea Battle concept is not a strategy—to answer your question on

(...continued)

Karotkin_Testimony1.30.14.pdf.

²⁷⁴ The title of the hearing as posted on the House Armed Services Committee website was: "USAF, USN and USMC Development and Integration of Air/Sea Battle Strategy, Governance and Policy into the Services' Annual Program, Planning, Budgeting and Execution (PPBE) Process."

the difference between AirLand Battle and the AirSea Battle concept. National or military strategies employs ways and means to a particular and/or end-state, such as deterring conflict, containing conflict or winning conflict.

A concept in contrast is a description of a method or a scheme for employing military capabilities to attain specific objectives at the operational level of war. The overarching objective of the AirSea Battle concept is to gain and maintain freedom of action in the global commons.

The AirSea Battle does not focus on a particular adversary or a region. It is universally applicable across all geographic locations, and by addressing access challenges wherever, however, and whenever we confront them.

I said earlier that the AirSea Battle represents a new approach to warfare. Here's what I meant by that. Historically, when deterrence fails, it's our custom to amass large numbers of resources, leverage our allies for a coalition support and base access or over flight and build up an iron mountain of logistics, weapons and troops to apply overwhelming force at a particular space and time of our choosing.

This approach of build up, rehearse and roll back has proven successful from Operation Overlord in the beaches of Normandy in 1944 to Operation Iraqi Freedom in the Middle East. But the 21st Century operating environment is changing. Future generations of American service men and women will not fight their parents' wars.

And so I'll borrow a quote from Abraham Lincoln, written in a letter to this House on 1 December, 1862 when he said, "We must think anew, act anew. We must disenthrall ourselves from the past, and then we shall save our country."

New military approaches are emerging specifically intended to counter our historical methods of projecting power. Adversaries employing such an approach would seek to prevent or deny our ability to aggregate forces by denying us a safe haven from which to build up, rehearse, and roll back.

Anti-Access is defined as an action intended to slow deployment of friendly forces into a theater or cause us to operate from longer distances than preferred. Area Denial impedes friendly operations or maneuver in a theater where access cannot be prevented.

The AirSea Battle concept mitigates the threat of Anti-Access and Area Denial by creating pockets and corridors under our control. The reason conflict in Libya, Operation Odyssey Dawn in 2011, is a good example of this paradigm shift.

Though AirSea Battle was still in development, the fundamental idea of leveraging access in one domain to provide advantage to our forces in another was understood and employed against Libya's modest Anti-Access/Area Denial capability.

On day one of combat operations, cruise missiles launched from submarines and surface ships in the maritime domain targeted and destroyed Libya's lethal air defense missile systems; thereby enabling coalition forces to conduct unfettered follow-on strikes and destroy the Libyan Air Force and control the air domain.

Establishing a no-fly zone, key to interdicting hostile regime actions against innocent civilians—and that was our mission, to protect civilians—was effectively accomplished within 48 hours of receiving the execution order from the President. I was the J3 or the operations officer for Admiral Sam Locklear, Commander of Joint Task Force, Odyssey Dawn. And I transitioned from U.S.-led coalition operations to Operation Unified Protector as a taskforce commander for NATO.

During the entire campaign which lasted seven months, NATO reported in its UN After Action Report that there were just under 18,000 sorties flown, employing 7,900 precision guided munitions. That's a lot. More than 200 Tomahawk Land Attack Missiles were used, over half of which came from submarines.

The majority of the Libyan Regime Order of Battle, which included 800 main battle tanks, 2,500 artillery pieces, 2,000 armored personnel carriers, 360 fixed wing fighters and 85 transports were either disabled or destroyed during the campaign.

Not one American boot set foot on the ground; no Americans were killed in combat operations. We lost one F-15 due to mechanical failure but we recovered both pilots safely. Muammar Gaddafi, as you know, was killed by Libyan rebels in October, 2011.

The AirSea Battle Concept, in its classified form, was completed in November 2011, one month later. I provided Admiral Locklear with a copy of the AirSea Battle concept and we reviewed it on a trip to United Kingdom. Upon reading it, I thought back to the Libya campaign plan and I wondered how I might leverage the concepts of AirSea Battle to fight differently, to fight smarter.

Operation Odyssey Dawn accelerated from a non-combatant evacuation operation and humanitarian assistance to kinetic operations in a very short period. There was very little time for build-up and rehearse our forces. To coin a phrase from my boss, this was like a pickup game of basketball. And we relied on the flexibility, innovation and resiliency of the commanders of the forces assigned to the joint taskforce.

The Libyan regime's Anti Access Area Denial capability was limited as I said. And we were able to overwhelm and defeat it with the tools that we had. But we must prepare for a more stressing environment in the future. AirSea Battle does so, by providing commanders with a range of options, both kinetic and non-kinetic to mitigate or neutralize challenges to access in one or many domains simultaneously.

This is accomplished through development of networked integrated forces capable of attack in-depth to disrupt, destroy and defeat the adversary. And it provides maximum operational advantage to friendly joint and coalition forces. I'm a believer and so are the rest of the flag and general officers here at the table with me.²⁷⁵

DOD Unclassified Summary Released June 2013

On June 3, 2013, DOD released an unclassified summary of the Air-Sea Battle concept.²⁷⁶

²⁷⁵ Source: transcript of hearing.

²⁷⁶ Air-Sea Battle Office, *Air-Sea Battle[:] Service Collaboration to Address Anti-Access & Area Denial Challenges*, May 2013, 13 pp., accessed March 24, 2017, at <http://archive.defense.gov/pubs/ASB-ConceptImplementation-Summary-May-2013.pdf>. DOD officials had discussed the ASB concept in earlier statements; for example:

- Admiral Jonathan Greenert, the Chief of Naval Operations, and General Mark Welsh, the Chief of Staff of the Air Force, discussed the ASB concept in a May 16, 2013, blog post; see Jonathan Greenert and Mark Welsh, "Breaking the Kill Chain[:] How to Keep America in the Game When Our Enemies Are Trying to Shut Us Out," *Foreign Policy*, May 16, 2013, accessed July 5, 2013, at http://www.foreignpolicy.com/articles/2013/05/16/breaking_the_kill_chain_air_sea_battle.
- General Norton Schwartz, then-Chief of Staff of the Air Force, and Admiral Jonathan Greenert, the Chief of Naval Operations, discussed the ASB concept in a February 20, 2012, journal article; see Norton A. Schwartz and Jonathan W. Greenert, "Air-Sea Battle, Promoting Stability In An Era of Uncertainty," *The American Interest*, February 20, 2012, accessed July 5, 2013, at <http://www.the-american-interest.com/article.cfm?piece=1212>.
- The Air-Sea Battle Office released a statement on the ASB concept on November 9, 2011; see "The Air-Sea Battle Concept Summary," accessed July 5, 2013, at http://www.navy.mil/search/display.asp?story_id=63730.

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