

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

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## Summary

China is building a modern and regionally powerful navy with a limited but growing capability for conducting operations beyond China's near-seas region. 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.

Observers of Chinese and U.S. military forces view China's improving naval capabilities as posing a potential 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 an emerging 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 broad array of platform and weapon acquisition programs, including anti-ship ballistic missiles (ASBMs), anti-ship cruise missiles (ASCMs), submarines, surface ships, aircraft, 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 or defending China's territorial claims in the South China Sea and East China Sea; 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); 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 anti-piracy) 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;
- 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 DOD report to Congress on military and security developments involving China,<sup>1</sup> 2015 and 2009 reports on China's navy from the Office of Naval Intelligence (ONI),<sup>2</sup> 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*

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<sup>1</sup> Department of Defense, *Annual Report to Congress [on] Military and Security Developments Involving the People's Republic of China 2016*, April 26, 2016. Hereinafter *2016 DOD CMSD*. The 2010-2015 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.

<sup>2</sup> Office of Naval Intelligence, *The PLA Navy, New Capabilities and Missions for the 21<sup>st</sup> 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.<sup>3</sup>

## Background

### Overview of China's Naval Modernization Effort<sup>4</sup>

#### Date of Inception

China's military (including naval) modernization effort has been underway for more than 25 years. Observers date the beginning of the effort to various points in the 1990s.<sup>5</sup> Design work on the first of China's newer ship classes appears to have begun in the later 1980s.<sup>6</sup> 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,<sup>7</sup> 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.<sup>8</sup>

#### 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, unmanned aircraft, submarines, aircraft carriers, destroyers, frigates, corvettes, patrol craft, amphibious ships, mine countermeasures (MCM) ships, underway replenishment ships, hospital ships, and supporting C4ISR<sup>9</sup> systems. Some of these acquisition programs are discussed in further detail below. China's naval modernization effort also includes improvements in maintenance and logistics, doctrine, personnel quality, education and training, and exercises.

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

<sup>4</sup> Unless otherwise indicated, shipbuilding program information in this section is taken from *IHS Jane's Fighting Ships 2016-2017*, 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.

<sup>5</sup> China ordered its first four Russian-made Kilo-class submarines in 1993, and its four Russian-made Sovremenny-class destroyers in 1996. China laid the keel on its first Song (Type 039) class submarine in 1991, its first Luhu (Type 052) class destroyer in 1990, its Luhai (Type 051B) class destroyer in 1996, and its first Jiangwei I (Type 053 H2G) class frigate in 1990.

<sup>6</sup> First-in-class ships whose keels were laid down in 1990 or 1991 (see previous footnote) likely reflect design work done in the latter 1980s.

<sup>7</sup> See, for example, Robert Farley, "What Scares China's Military: The 1991 Gulf War," *National Interest*, November 24, 2014.

<sup>8</sup> 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.)

<sup>9</sup> C4ISR stands for command and control, communications, computers, intelligence, surveillance, and reconnaissance.

## Quality vs. Quantity

China's naval modernization effort to date has appeared 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 have generally been more dramatic than changes in total platform numbers. In some cases (such as submarines and coastal patrol craft), total numbers of platforms have actually decreased over the past 20 years or so, but aggregate capability has 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.

DOD states that "China 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."<sup>10</sup> ONI states 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."<sup>11</sup>

Some categories of ships, however, are clearly 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 one or 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 at least 31 had entered service as of early 2017, with some observers projecting an eventual force of more than 60.

China is also building large numbers of cutters for its coast guard, and total numbers of larger cutters have grown 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:

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.<sup>12</sup>

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<sup>10</sup> 2016 DOD CMSD, p. 25.

<sup>11</sup> 2015 ONI Report, p. 5. See also p. 13.

<sup>12</sup> Zhang Tao, "Navy Upgrades Missile Destroyer," *China Military*, February 22, 2017.



## 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,<sup>13</sup> antisubmarine warfare (ASW),<sup>14</sup> a dependence on foreign suppliers for some ship components,<sup>15</sup> and long-range targeting.<sup>16</sup> China is working to overcome such limitations and weaknesses.<sup>17</sup> ONI states that "Although the PLA(N) faces some capability gaps in key areas, it is emerging as a well equipped and competent force."<sup>18</sup>

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 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;

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<sup>13</sup> 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.

<sup>14</sup> DOD states that "China is making gradual progress in the undersea domain as well, but continues to lack either a robust coastal or deep-water anti-submarine warfare capability." (2016 DOD CMSD, p. 61.)

<sup>15</sup> 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." (2016 DOD CMSD, p. 80.) 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.

<sup>16</sup> DOD states that "It is also unclear whether China has the capability to collect accurate targeting information and to pass it to launch platforms in time for successful strikes in sea areas beyond the first island chain." (2016 DOD CMSD, p. 61.)

See also Dennis J. Blasko, "Ten Reasons Why China Will Have Trouble Fighting A Modern War," *War on the Rocks*, February 18, 2015; Paul Dibb, "Why the PLA Is A Paper Tiger," *Real Clear Defense*, October 15, 2015. (For a rebuttal to Dibb's article, see Malcolm David, "The PLA is No Paper Tiger," *Real Clear Defense*, October 19, 2015; and Malcolm Davis, "Why the PLA is No Paper Tiger (Part 2)," *Real Clear Defense*, October 22, 2015. See also Roger Cliff, "China's Military: Mighty Dragon or Paper Tiger?" *National Interest*, September 22, 2015.) See also Richard A. Bitzinger, "China's Not-So-Wonderful Weapons," *Asia Times*, February 23, 2016.

<sup>17</sup> See, for example, 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; Rielage, Dale C., "Chinese Navy Trains and Takes Risks," *U.S. Naval Institute Proceedings*, May 2016; Robert Beckhusen, "The Chinese Navy Is Behind America in One Key Area (But Not For Long)," *National Interest*, May 17, 2016. Regarding China's efforts to overcome its limitations in ASW in particular, see, for example, Richard D. Fisher Jr., "China Proposes 'Underwater Great Wall' That Could Erode US, Russian Submarine Advantages," *Jane's Defence Weekly*, May 17, 2016; Lyle J. Goldstein, "China's 'Undersea Great Wall,'" *National Interest*, May 17, 2016.

<sup>18</sup> 2015 ONI Report, p. 13.

- asserting or 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;<sup>19</sup>
- 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);<sup>20</sup>
- defending China's commercial sea lines of communication (SLOCs), such as 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.<sup>21</sup>

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.<sup>22</sup> (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 anti-piracy) operations, evacuating Chinese nationals in foreign countries when necessary, and conducting humanitarian assistance/disaster response (HA/DR) operations.

DOD states that

The PRC continues to focus on preparing for potential conflict in the Taiwan Strait, but additional missions, such as contingencies in the East and South China Seas and on the Korean peninsula, are increasingly important to the PLA. Moreover, as China's global footprint and international interests grow, its military modernization program has become more focused on investments and infrastructure to support a range of missions beyond China's periphery, including power projection, sea lane security, counterpiracy, peacekeeping, and humanitarian assistance/disaster relief (HA/DR). PLA global operations in 2015 included counterpiracy patrols, humanitarian assistance and disaster relief, exercises, and sea lane security operations. China's November 2015 public confirmation of its intention to build its first overseas military support facility in Djibouti

<sup>19</sup> 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.

<sup>20</sup> 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).

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

<sup>22</sup> See, for example, *2016 DOD CMSD*, pp. 59-63.

likely reflects this more global outlook, as it will be utilized to sustain the PLA Navy's operations at greater distances from China.<sup>23</sup>

DOD also states that

The PLAN remains at the forefront of the military's efforts to extend its operational reach beyond East Asia and into what China calls the "far seas." Missions in these areas 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.

The PLAN's goal over the coming decades is to become a stronger regional force able to project power across the greater Asia-Pacific region for high-intensity operations over a period of several months. However, logistics and intelligence support remain key obstacles, particularly in the Indian Ocean and in other areas outside the greater Asia-Pacific region. As a result, China desires expansion of its access to logistics in the Indian Ocean and will probably establish several access points in this area in the next decade.<sup>24</sup>

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.'"<sup>25</sup> 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....

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

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<sup>23</sup> 2016 DOD CMSD, p. ii. See also page 66 and 2015 ONI Report, pp. 8-11.

<sup>24</sup> 2016 DOD CMSD, p. 68.

<sup>25</sup> 2016 DOD CMSD, p. 4.

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.<sup>26</sup>

## **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 hit moving ships at sea. DOD states that

China continues to field an ASBM based on a variant of the CSS-5 (DF-21) MRBM that it began deploying in 2010. The CSS-5 Mod 5 has a range of 1,500 km and is armed with a MaRV.<sup>27</sup>

DOD also states that "key systems that either have been deployed or are in development include ballistic missiles (including anti-ship variants)...."<sup>28</sup>

Another observer states that "the DF-21D's warhead apparently uses a combination of radar and optical sensors to find the target and make final guidance updates.... Finally, it uses a high explosive, or a radio frequency or cluster warhead that at a minimum can achieve a mission kill [against the target ship]."<sup>29</sup>

Observers have expressed strong concern about the DF-21D, 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 the DF-21 as a "game-changing" weapon. Due to their ability to change course, the MaRVs on an

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<sup>26</sup> 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](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.

<sup>27</sup> 2016 DOD CMSD, p. 67. See also 2009 ONI Report, pp. 26-27.

<sup>28</sup> 2016 DOD CMSD, p. 57.

<sup>29</sup> Richard Fisher Jr., "PLA and U.S. Arms Racing in the Western Pacific," available online at [http://www.strategycenter.net/research/pubID.247/pub\\_detail.asp](http://www.strategycenter.net/research/pubID.247/pub_detail.asp). A mission kill means that the ship is damaged enough that it cannot perform its intended mission.

ASBM would be more difficult to intercept than non-maneuvering ballistic missile reentry vehicles.<sup>30</sup>

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 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.<sup>31</sup>

DOD has been reporting on the DF-21D in its annual reports to Congress since 2008.<sup>32</sup> On September 3, 2015, at a Chinese military parade in Beijing that displayed numerous types of Chinese weapons, an announcer stated that a second type of Chinese ballistic missile, the DF-26, may have an anti-ship capability.<sup>33</sup> 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.<sup>34</sup>

China reportedly is developing a hypersonic glide vehicle that, if incorporated into Chinese ASBMs, could make Chinese ASBMs more difficult to intercept.<sup>35</sup>

### ***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

<sup>30</sup> For further discussion of China's ASBM and its potential implications for U.S. naval forces, see Andrew S. Erickson, “Raining Down: Assessing the Emergent ASBM Threat,” *Jane's Navy International*, March 16, 2016.

<sup>31</sup> “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>.

<sup>32</sup> 2008 DOD CMP, pp. 2 and 23.

<sup>33</sup> 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.

<sup>34</sup> 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.

<sup>35</sup> See, for example, 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; Bill Gertz, “China Successfully Tests Hypersonic Missile,” *Washington Free Beacon*, April 27, 2016; Harry J. Kazianis, “Asia's ‘Mach 5’ Nightmare: China's Hypersonic Weapons Build-Up,” *National Interest*, May 2, 2016; Matt Cox, “China's Hypersonic Glider Passes New Test,” *DefenseTech*, May 12, 2016; Jen Judson, “Hypersonic Weapons Threat Looms Large at Missile Defense Symposium,” *Defense News*, August 17, 2016; Marc Selinger, “Hypersonic Glide Vehicles Challenge U.S. Defenses, STRATCOM Chief Says,” *Defense Daily*, August 17, 2016: 2-3; Will Edwards and Luke Penn-Hall, “The Rise of Hypersonic Weapons,” *Cipher Brief*, October 5, 2016; Bill Gertz, “Air Force: Hypersonic Missiles From China, Russia Pose Growing Danger to U.S.,” *Washington Free Beacon*, November 30, 2016.



The PLAN is deploying a wide range of advanced ASCMs. The most capable include the domestically produced ship-launched YJ-62 ASCM and the Russian SS-N-22/SUNBURN supersonic ASCM, which is fitted on China's SOVREMENNY-class DDGs acquired from Russia. China's submarine force is also increasing its ASCM capability, with the long-range YJ-18 ASCM replacing the older YJ-82 on the SONG, YUAN, and SHANG classes. The YJ-18 is similar to the Russian SS-N-27B/SIZZLER ASCM, which is capable of supersonic terminal sprint and is fielded on eight of China's 12 Russian-built KILO SS. In addition, PLAN Aviation employs the 200 km range YJ-83K ASCM on its JH-7 and H-6G aircraft. China has also developed the YJ-12 ASCM for the PLAN. The new missile provides an increased threat to naval assets, due to its long range and supersonic speeds. It is capable of being launched from H-6 bombers.<sup>36</sup>

DOD also states that

The PLAN continues to emphasize anti-surface warfare (ASUW) as its primary focus, including modernizing its advanced ASCMs and associated over-the-horizon targeting systems. Older surface combatants carry variants of the YJ-83 ASCM (65 nm, 120 km), while newer surface combatants such as the LUYANG II are fitted with the YJ-62 (120 nm, 222 km). The LUYANG III and Type 055 CG will be fitted with a variant of China's newest ASCM, the YJ-18 (290 nm, 537 km), which is a significant step forward in China's surface ASUW capability. Eight of China's 12 KILOs 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, YUAN, and SHANG submarines. China's previously produced submarine-launched ASCM, the YJ-82, is a version of the C-801, which has a much shorter range. 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.<sup>37</sup>

## Submarines and Mines

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...."<sup>38</sup> 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.<sup>39</sup>

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<sup>36</sup> 2016 DOD CMSD, p. 72.

<sup>37</sup> 2016 DOD CMSD, p. 27. See also page 67. See also 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; Michael Pilger, "China's New YJ-18 Antiship Cruise Missile: Capabilities and Implications for U.S. Forces in the Western Pacific," U.S. China Economic and Security Review Commission Staff Research Report, October 28, 2015, 7 pp.; Lyle J. Goldstein, "YJ-18 Supersonic Anti-Ship Cruise Missile: America's Nightmare," *National Interest*, June 1, 2015; "CCTV Military Commentator Responds to US Report on YJ-18," *Want China Times*, April 18, 2015.

<sup>38</sup> 2016 DOD CMSD, p. 26.

<sup>39</sup> [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 (continued...)

### *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**);<sup>40</sup> 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.

### *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 aging 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.<sup>41</sup> A March 29, 2017, press report states:

China's efforts to lure its scientists back from overseas institutions have been paying off militarily, with more than a little help from the United States.

Military projects they have been involved in include China's development of hypersonic weapons capable of penetrating missile-defence systems and the design of new submarines able to patrol quietly along the US west coast, researchers familiar with the programmes told the South China Morning Post.

For more than a decade, China has been ramping up efforts to lure back talented scientists working at laboratories in the US linked to America's nuclear weapons programme and

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(...continued)

Mines," *National Interest*, October 14, 2015.

<sup>40</sup> Some sources refer to the Yuan class as the Type 041.

<sup>41</sup> 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.)

other military research, as well as those working for Nasa and companies such as Lockheed Martin Space Systems and Boeing.

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



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

Many of the scientists returning to China have worked at the Los Alamos National Laboratory in New Mexico, the birthplace of the atomic bomb, the Lawrence Livermore National Laboratory in California, which plays a key role in today's US nuclear weapons programme, or the Air Force Research Laboratory at Wright-Patterson Air Force Base in Ohio.

While the numbers remain unknown, so many scientists from Los Alamos have returned to Chinese universities and research institutes that people have dubbed them the "Los Alamos club".

The Los Alamos laboratory, home to a wide range of defence research facilities, including a supercomputer and particle accelerator used for weapons research, has hired many foreign scientists to compensate for a shortage of American science and engineering talent. Its website says more than 4 per cent of its nearly 10,000 employees are of Asian origin....

One scientist who returned from Los Alamos was Professor Chen Shiyi, who as director of the State Key Laboratory for Turbulence and Complex Systems at Peking University played a key role in the development of China's hypersonic glide vehicle, a researcher at the Chinese Academy of Sciences (CAS) in Beijing told the Post....

...Dr He Guowei, a researcher with CAS's Institute of Mechanics, left Los Alamos shortly after Chen. Also a turbulence scientist, his team is now developing computer models for submarine development, according to the institute's website.

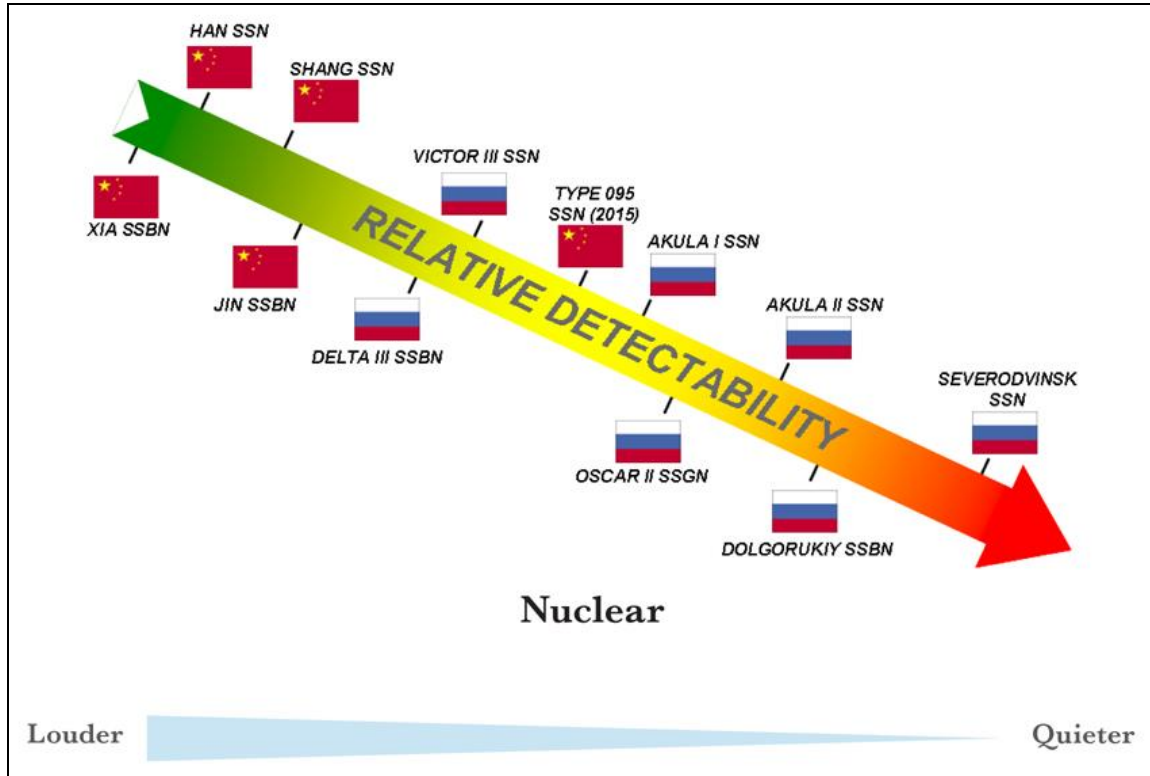
A recent breakthrough allowed them to predict the turbulence generated by a submarine more quickly and accurately. The technology will allow China to build quieter submarines and better detect foreign ones.



He declined to talk about his work at Los Alamos, saying: “It was long time ago. What I knew is no longer relevant.”<sup>42</sup>

**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.

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



Source: 2009 ONI Report, p. 22.

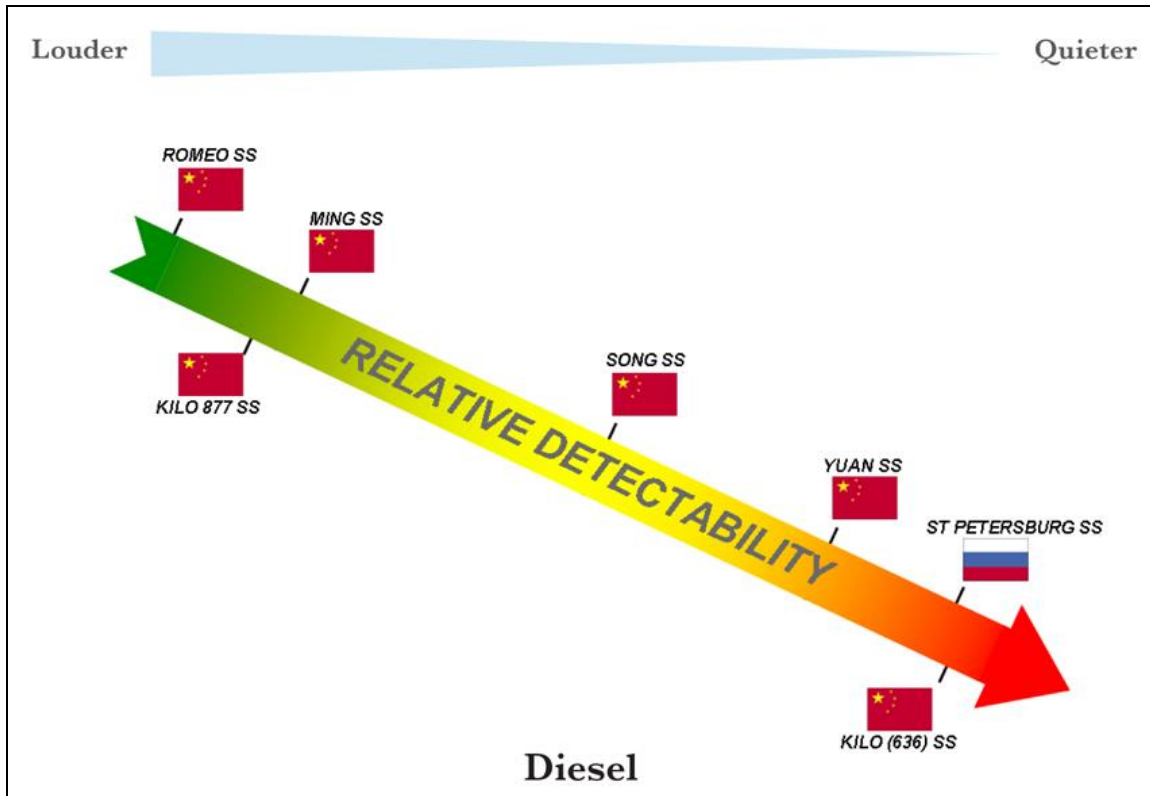
In **Figure 3** and **Figure 4**, the downward slope of the arrow indicates the increasingly lower noise levels (i.e., increasing acoustic quietness) of the submarine designs shown. In general, quieter submarines are more difficult for opposing forces to detect and counter. The green-yellow-red color 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 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. China's submarines are armed with one or more of the following: ASCMs, wire-guided and wake-homing torpedoes, and mines. 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

<sup>42</sup> Stephen Chen, “America’s Hidden Role in Chinese Weapons Research,” *South China Morning Post*, March 29, 2017.

sources of concern, wake-homing torpedoes are also a concern because they can be very difficult for surface ships to counter.

**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:

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 (known, by the way, as the Ohio SSBN), the Type 094A is likely to include acoustic quieting technologies found on the Type 093A.<sup>43</sup>

### ***Nuclear-Powered Attack Submarines***

Regarding nuclear-powered attack submarines, DOD states, “Over the next decade, China may construct a new Type 095 nuclear-powered, guided-missile attack submarine (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.”<sup>44</sup> 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.<sup>45</sup>

A June 27, 2016, blog post states:

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.”<sup>46</sup>

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<sup>43</sup> Jeffrey Lin and P.W. Singer, “China’s New Ballistic Missile Submarine Could Change Its Prospects in Nuclear War,” *Popular Science*, January 10, 2017.

<sup>44</sup> 2016 DOD CMSD, p. 26.

<sup>45</sup> 2015 ONI Report, p. 19. See also Lyle Goldstein, “Emerging From The Shadows,” *U.S. Naval Institute Proceedings*, April 2015: 30-34.

<sup>46</sup> 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.

### ***Non-Nuclear-Powered Attack and Auxiliary Submarines***

Regarding non-nuclear-powered attack submarines, a January 5, 2017, press report states:

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.<sup>47</sup>

DOD states that China is pursuing “a new joint-design and production program [with Russia] for a heavy-lift helicopter and diesel-electric submarines based on the Russian PETERSBURG/LADA-class.”<sup>48</sup>

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.”<sup>49</sup>

Although China’s aging 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 2016-2017*, that is about one-third larger than the Yuan-class design. Observers believe the boat may be a one-of-kind test platform; *IHS Jane’s Fighting Ships 2016-2017* refers to it as an auxiliary submarine (SSA).<sup>50</sup>

### ***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.

As shown in **Table 1**, China by the end of 2015 is expected to have a total of 41 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 placed or was expected to place into service a total of 56 submarines of all kinds, or an average of about 2.55 submarines per year. This average commissioning rate, if sustained indefinitely, would eventually result in a steady-state submarine force of about 51 to 76 boats of all kinds, assuming an average submarine life of 20 to 30 years.

<sup>47</sup> Andrew Tate, “China Resumes Production of Yuan-Class Submarines,” *IHS Jane’s 360*, January 5, 2017.

<sup>48</sup> 2016 DOD CMSD, p. 81.

<sup>49</sup> Jamie Seidel, “Mini Submarine Captured on Satellite Photo of Chinese Dockyard,” *News.com.au*, June 29, 2015.

<sup>50</sup> *IHS Jane’s Fighting Ships 2016-2017*, p. 138.

**Table I. 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 <sup>a</sup>	Song (Type 039/039G) SS	Yuan (Type 039A/B/C) SS <sup>b</sup>	Qing (Type 032) SS	Annual total for all types shown	Cumulative total for all types shown	Cumulative total for modern attack boats <sup>c</sup>
1995			2 <sup>d</sup>	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 <sup>e</sup>	7	52	39
2013								0	52	39
2014								0	52	39
2015	1					2 <sup>f</sup>		3	55	41
2016		1						1	56	42
2017	1	1 <sup>h</sup>				n/a		n/a	n/a	n/a
2018		n/a				n/a		n/a	n/a	n/a
2019	1 <sup>g</sup>	n/a				n/a		n/a	n/a	n/a

**Source:** *IHS Jane's Fighting Ships 2016-2017*, and (for Ming class) previous editions.**Note:** n/a = data not available.

- 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.
- Some sources refer to the Yuan class as the Type 041.
- 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).
- IHS Jane's Fighting Ships 2016-2017* lists the commissioning date of one of the two Kilos as November 15, 1994.
- Observers believe this boat may be a one-of-kind test platform; *IHS Jane's Fighting Ships 2016-2017* refers to it as an auxiliary submarine (SSA).
- IHS Jane's Fighting Ships 2016-2017* states that a class of 20 boats is expected. DOD states that a total of 20 are planned for production. (2016 DOD CMSD, p. 26) ONI states that as many as 20 may be produced. (2015 ONI Report, p. 19)
- IHS Jane's Fighting Ships 2016-2017* states that a total of six boats are expected, with the final four boats built to a modified (Type 093A) design. DOD similarly states that a total of six are expected (2016 DOD CMSD, p. 26.)
- IHS Jane's Fighting Ships 2016-2017* states that a total of eight boats is expected. DOD states that a total of "up to five may enter service before china begins developing and fielding its next-generation SSBN, the Type 096, over the coming decade." (2016 DOD CMSD, p. 26.)

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 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 40 to 60 boats of all kinds, again assuming an average submarine life of 20 to 30 years.

DOD states that “by 2020, [China’s submarine] force will likely grow to between 69 and 78 submarines.”<sup>51</sup> ONI states that “by 2020, the [PLA(N)] submarine force will likely grow to more than 70 submarines.”<sup>52</sup> In an accompanying table, ONI provides a more precise projection of 74 submarines in 2020, including 11 nuclear-powered boats and 63 non-nuclear-powered boats.<sup>53</sup> 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.<sup>54</sup>

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. This, however, may be about to change: An April 2, 2017, blog post states that

... there are some palpable signs that the PLAN submarine force might be seeking a return to the limelight after some years in the shadows. First, my colleague Conor Kennedy has unearthed an article on the China Strategic Emerging Industry... website that suggests that China is in the process of completing perhaps the world’s largest nuclear submarine fabrication facility....

According to the article from the China Strategic Emerging Industry site, “Many media outlets are reporting that China’s Bohai Shipbuilding Heavy Industry Co. has built a new large-size factory.” Later, the new facility at Huludao is described as a “super factory”... and it is noted with great pride that that the fabrication shed was erected in just one year. In terms of size comparisons, this piece asserts that it is the world’s largest: “Western production lines for the most part can only build one submarine, and only the US is capable of building two submarines simultaneously, but China is now capable of building four!”

According to this article... it is speculated that the new facility is to build the successor third-generation classes of Type 096 ballistic missile submarines and Type 095 attack submarines. The new submarines will be built using modular fabrication techniques. The projection is made that Chinese nuclear submarine production will double its rate within two to three years. The advantages of the new facility for production in all-weather conditions, and in terms of hiding the building from U.S. spy satellites, are duly noted. The author reveals that within Chinese Navy circles the question of whether to prioritize the aircraft carrier, or large surface ships or nuclear submarines, has formed a “focal point of debate”..., but concludes that there is a consensus behind “balanced development”... and nuclear submarines are a key part of that balance....

At the very least, the Washington strategic studies community might want to shift some of their ample attention from scrutinizing satellite photos of reef outposts to examining the industrial activities around an exceedingly large shed on the Bohai Sea.<sup>55</sup>

<sup>51</sup> 2016 DOD CMSD, p. 26.

<sup>52</sup> 2015 ONI Report, p. 19.

<sup>53</sup> 2015 ONI Report, p. 18.

<sup>54</sup> Richard Halloran, “China, US Engaging in Underwater Arms Race,” *Taipei Times*, May 16, 2013: 8, accessed May 17, 2013, at <http://www.taipeitimes.com/News/editorials/archives/2013/05/16/2003562368>.

<sup>55</sup> Lyle J. Goldstein, “China Prepares to Ramp Up its Shipbuilding Process,” *National Interest*, April 2, 2017.



An April 19, 2017, press report similarly states:

Starting later this year, China's new submarine factory on the Yellow Sea will churn out nuclear-powered attack submarines—also known as SSNs....

Bohai Shipbuilding Heavy Industrial Corporation is putting the finishing touches on its new facility, which will start production this year. BSHIC, based in Huludao, Liaoning Province, is China's only builder of nuclear submarines. It previously built the Type 091, 093 nuclear attack submarines (SSN) and Type 092 and 094 nuclear ballistic missile submarine (SSBN).

The massive new assembly hall, which measures more than 430,000 square feet, has enough room for two parallel production lines; each production line has one half dedicated to assembling and attaching together submarine modules, and the other half dedicated to finishing the hull with quieting measures like anechoic tiles. That's enough space for four SSN's to be built simultaneously (two sets of modules being assembled at one end, and another pair of assembled hulls being fitted out before launch). Once completed, the SSN is rolled off the line and into the ocean. The assembly hall can also handle construction of the next generation SSBN, the Type 096.

The facility is reported to begin construction on the first Type 095 SSN later this year.<sup>56</sup>

### ***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.<sup>57</sup> Each Jin-class SSBN is expected to be armed with 12 JL-2 nuclear-armed submarine-launched ballistic missiles (SLBMs). DOD states that

China continues to produce the JIN-class SSBN (Type 094) with associated CSS-N-14 (JL-2) submarine-launched ballistic missiles (SLBM) that has an estimated range of 7,200 km [3,888 nautical miles]. This platform represents China's first credible, sea-based nuclear deterrent. China will probably conduct its first SSBN nuclear deterrence patrol sometime in 2016. Four JIN SSBNs are operational, and up to five may enter service before China begins developing and fielding its next-generation SSBN, the Type 096, over the coming decade. The Type 096 will reportedly be armed with a successor to the JL-2, the JL-3 SLBM.<sup>58</sup>

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 mid-ocean locations west of Hawaii; and
- targets in all 50 states from mid-ocean locations east of Hawaii.

<sup>56</sup> Jeffrey Lin and P.W. Singer, "China Is Building the World's Largest Nuclear Submarine Facility," *Popular Science*, April 19, 2017.

<sup>57</sup> 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.

<sup>58</sup> 2016 DOD CMSD, p. 26. See also pages 38 and 58, and 2015 ONI Report, pp. 19-20.

## Mines

China has modernized its substantial inventory of naval mines.<sup>59</sup> 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.<sup>60</sup>

## Aircraft Carriers and Carrier-Based Aircraft<sup>61</sup>

China has begun operating its first aircraft carrier—the *Liaoning*, a refurbished ex-Ukrainian aircraft carrier that entered service in 2012. China is well along with the construction of a second carrier (China’s first indigenously built aircraft carrier)—reportedly called *Shandong*—and may have begun construction on a third carrier. Observers speculate China may eventually field a force of four to six aircraft carriers.<sup>62</sup>

### 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.<sup>63</sup>

The *Liaoning* is conventionally powered, has an estimated full load displacement of almost 60,000 tons,<sup>64</sup> 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 may consist of 24 J-15 fighters, 6 anti-submarine warfare helicopters, 4 airborne early warning

<sup>59</sup> See, for example, Scott C. Truver, “Taking Mines Seriously, Mine Warfare in China’s Near Seas,” *Naval War College Review*, Spring 2012: 30-66.

<sup>60</sup> 2015 ONI Report, pp. 23-24.

<sup>61</sup> 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.

<sup>62</sup> See, for example, Jamie Seidel, “China Is About to Launch Its Second Aircraft Carrier, 001A,” *News.com.au*, March 6, 2017.

<sup>63</sup> 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.

<sup>64</sup> *IHS Jane’s Fighting Ships 2016-2017* lists a full load displacement of 59,439 tons for the ship.



helicopters, and 2 rescue helicopters, for a total of 36 aircraft.<sup>65</sup> The *Liaoning* lacks aircraft catapults and instead launches fixed-wing airplanes off the ship's bow using an inclined "ski ramp."

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



**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](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.<sup>66</sup> DOD states that

Even when fully operational, LIAONING will not enable long-range power projection similar to U.S. NIMITZ-class carriers. LIAONING's smaller size limits the number of aircraft it can embark, while the ski-jump configuration limits aircraft fuel and ordnance loads.<sup>67</sup>

<sup>65</sup> Wendell Minnick, "Chinese Carrier's Purported Air Wing Deemed Plausible But Limited," *Defense News* ([www.defensenews.com](http://www.defensenews.com)), September 7, 2014.

<sup>66</sup> See, for example, 2015 *ONI Report*, p. 23, and "China Plans New Generation of Carriers as Sea Disputes Grow," *Bloomberg News*, April 24, 2013.

<sup>67</sup> 2016 *DOD CMSD*, p. 28.

ONI states that

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.<sup>68</sup>

The PLA Navy is currently learning to operate aircraft from the ship. DOD states that "in 2015, the PLAN's first aircraft carrier, LIAONING, certified its first cohort of domestically trained J-15 operational pilots. The air wing is expected to deploy on the carrier in 2016."<sup>69</sup> ONI states that "full integration of a carrier air regiment remains several years in the future, but remarkable progress has been made already,"<sup>70</sup> and that "it will take several years before Chinese carrier-based air regiments are operational."<sup>71</sup> 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."<sup>72</sup> In November 2016, the ship was reportedly described as being ready for combat.<sup>73</sup> A January 7, 2017, blog post states:

It seems to most PLAN watchers that PLAN has been able to [develop] carrier aviation operations reasonably quickly since CV-16 [i.e., *Liaoning*] was first commissioned. In the 4 years since that time, we have seen more intensive take-off and landings from CV-16. CV-16 was even declared fully operational and combat ready earlier this year. It seemed a little premature at the time, since how would one quantify the move from training to combat ready. This most recent deployment does seem to resemble a combat ready carrier operation. First of all, we saw more aircraft on deck than at any time before. There were pictures showing 13 J-15s and 1 Z-18 [helicopter] on deck at the same time. I am sure more aircraft were in the hangar at the time. There were also pictures showing 7 helicopters and multiple J-15s at the same time. That's definitely something [the] Russian Navy is not capable of carrying out at the moment. Secondly, the J-15s appeared to have been taking off and landing in very quick succession based on the still photos that we saw. There were 2 J-15s set up in take off location with more J-15 looked ready to be moved over after each takeoff. We have yet to see night time operation photos of J-15, but this reportedly have also taken place in South China Sea. After that, the next big hurdle for J-15 operations would be taking off and landing in bad weather and high sea state conditions. What they have achieved thus far in terms of flight operation intensity at different times of day is something they didn't even train on land before PLAAF's modernization efforts. And finally, we have seen a variety of helicopters and J-15s set up for different missions. J-15s have been shown carrying AAMs and ASHMs [anti-ship missiles] for air superiority roles and anti-shipping roles. An EW [electronic warfare] variant of [the] J-15 was developed and flew last year. We have also seen J-15 with [an] UPAZ-1A refueling pod under [its] centerline to allow for buddy to buddy refueling.

<sup>68</sup> 2015 ONI Report, p. 23.

<sup>69</sup> 2016 DOD CMSD, pp. 27-28.

<sup>70</sup> 2015 ONI Report, p. 13.

<sup>71</sup> 2015 ONI Report, p. 23.

<sup>72</sup> "Over 20 J-15 Fighters Can Land on the Liaoning Aircraft Carrier," *People's Daily Online*, September 7, 2015.

<sup>73</sup> 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.

While this is not ideal, J-15s have already shown more multi-role capabilities than [the] Su-33 showed with [the Russian] Adm K[uznetsov] carrier.<sup>74</sup>

### *Second Carrier: Shandong (Type 001A)*

China is well along with the construction of its second aircraft carrier—China’s first indigenously built carrier (**Figure 6** and **Figure 7**). China officially confirmed the ship’s construction in December 2015.<sup>75</sup> Reportedly to be named *Shandong*, for the Chinese province, and also referred to as the Type 001A design, the ship was launched (that is, put into the water for the final stages of construction) on April 26, 2017.<sup>76</sup>

*Shandong* is believed to be broadly similar to *Liaoning*—like *Liaoning*, it will use a ski ramp rather than catapults to launch its aircraft—but it reportedly will also incorporate certain design improvements over *Liaoning*. A March 6, 2017, press report states:

Project 001A does appear to have many revised features over its Soviet predecessor.

“Its design, combat capability and technologies will be much more advanced,” Chinese military analyst Song Zhongping told the Global Times outlet of the People’s Daily.

“One key difference is the design will be more ‘humanised,’ which means all personnel on the carrier will enjoy a more comfortable and modern environment.”

But improvements also appear to extend to technical matters.

Its flight deck arrangement has been changed, as have the sponsons — projections from the sides of the ship holding weapons, sensors and other equipment. This, combined with an enlarged hangar, is said to allow 001A to carry between six and eight more fighter jets than the 24 *Liaoning* can stow.

The control-tower superstructure also appears to have been modified to accommodate new radars and masts. It was lifted into place on the new hull late last year.

“The Type 001A has learned from US carriers to focus on how to make aircraft on board more functional.” Beijing-based military analyst Li Jie recently told the South China Morning Post.

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<sup>74</sup> Feng, “Naval Aviation,” *China Air and Naval Power*, January 7, 2017. See also K.J.M. Varma, “China Developing Naval Aviation Wing to Operate from Aircraft [Carrier],” *Live Mint*, August 11, 2016.

<sup>75</sup> Sam LaGrone, “Officials Confirm Construction of First Domestic Chinese Aircraft Carrier,” *USNI News*, January 4, 2016; Zhang Tao, “2<sup>nd</sup> Aircraft Carrier To Have Military Focus,” *China Daily*, January 4, 2016; Chris Buckley, “China Says It is Building Its Second Aircraft Carrier,” *New York Times*, December 31, 2015. See also Sean O’Connor and James Hardy, “Latest Imagery Suggests Chinese Aircraft Carrier Is Under Construction,” *IHS Jane’s Defence Weekly*, November 18, 2015: 8; Jeffrey Lin and P.W. Singer, “China’s First Homemade Carrier Moves Forward,” *Popular Science*, October 27, 2015; Nanae Kurashige, “China Building First of Two Domestic Aircraft Carriers,” *Asahi Shimbun*, October 21, 2015; Brendan McGarry, “Satellite Images May Show China’s First Domestic Aircraft Carrier,” *Defense Tech*, October 1, 2015; Ankit Panda, “Is This China’s First Homemade Aircraft Carrier?” *The Diplomat*, October 2, 2015; Sam LaGrone, “China’s Domestic Aircraft Carrier Almost Certainly Under Construction,” *USNI News*, September 30, 2015; J.R. Wu, “China Building Two Aircraft Carriers: Taiwan Defense Ministry Report,” *Reuters*, September 3, 2015; Bradley Perrett, “China Building Third Carrier, Taiwanese Report Says,” *Aerospace Daily & Defense Report*, September 16, 2015: 4.

<sup>76</sup> 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.

While the ship may appear visually complete, it is yet to be fitted out. This means it is largely empty, with equipment such as radios and radars — even kitchen appliances and crew bunks — still needing to be installed.

“It will take about one to two years to carry out functional debugging of its devices, weapons and equipment,” Li Jie told the People’s Daily. “The new aircraft carrier can begin sea trials by early 2019.”<sup>77</sup>

**Figure 6. Shandong (Type 001A) Under Construction**

Picture dated November 30, 2016



**Source:** Photo captioned “The new aircraft carrier, Project 001A, takes shape in China’s Dalian shipyard. It is almost due to be launched. Picture taken on Nov. 30, 2016. Picture: DigitalGlobe via Google EarthSource: Supplied,” published as part of Jamie Seidel, “China Is About to Launch Its Second Aircraft Carrier, 001A,” *News.com.au*, March 6, 2017.

<sup>77</sup> Jamie Seidel, “China Is About to Launch Its Second Aircraft Carrier, 001A,” *News.com.au*, March 6, 2017. See also Yang Sheng, “2<sup>nd</sup> Carrier Almost Complete,” *Global Times*, February 21, 2017; Zhong Nan, “Liftoff for Heavy-Duty Gas Turbines, Breakthrough Made for Use in Aircraft Carriers,” *China Daily*, February 15, 2017; Mike Yeo, “Analysis: Chinese Aircraft Carrier Program Progressing Substantially Into the New Year,” *Defense News*, January 31, 2017; Judy Hua and Benjamin Kang Lim, “China’s Second Aircraft Carrier ‘Takes Shape:’ Media,” *Reuters*, January 31, 2017; “China’s Second Aircraft Carrier Features Smaller Island to Maximize Carrying Capacity: Military Expert,” *People’s Daily Online*, September 8, 2016; Ankit Panda, “China’s First Homemade Carrier Could Take to the Seas Later This year,” *The Diplomat*, August 29, 2016.



### Figure 7. Shandong (Type 001A) Under Construction

Picture dated December 2016



**Source:** Photo captioned “China’s first domestically made aircraft carrier under construction in Dalian in early December 2016. Picture via Kyodo Source: Supplied, published as part of Jamie Seidel, “China Is About to Launch Its Second Aircraft Carrier, 001A,” *News.com.au*, March 6, 2017.

### *Third Carrier (Type 002) and Subsequent Carriers*

DOD states that China “could build multiple aircraft carriers over the next 15 years.”<sup>78</sup> As stated earlier, observers speculate China may eventually field a force of four to six aircraft carriers, meaning *Liaoning*, *Shandong*, and two to four additional carriers. Observers speculate that China’s third and subsequent carriers may use catapults rather than ski ramps, and that at least some of them might be nuclear-powered rather than conventionally powered.<sup>79</sup>

A March 29, 2017, press report states that that China’s third carrier, referred to as the Type 002 design, “has been under construction at the Jiangnan Changxingdao shipyard in Shanghai since March 2015. It is expected to be launched [i.e., put into the water for the final stages of construction] in about 2021.”<sup>80</sup> A March 6, 2017, press report states:

It’s much bigger [than *Liaoning* and *Shandong*]. It’s probably nuclear powered. And it’s said to be much, much more like US aircraft carriers in both form and function.

And there are even more to come.

<sup>78</sup> 2016 DOD CMSD, p. 28.

<sup>79</sup> See, for example, “Third China-Made Aircraft Carrier Could Be Nuclear-Powered: Expert,” *People’s Daily Online*, April 14, 2017.

<sup>80</sup> Minnie Chan, “China Building Navy’s Biggest Amphibious Assault Vessel, Sources Say,” *South China Morning Post*, March 29, 2017.

“In order to protect China’s territories and overseas interests, China needs two carrier strike groups in the West Pacific Ocean and two in the Indian Ocean. So we need at least five to six aircraft carriers,” a Chinese defence analyst recently told the People’s Daily....

In 2013 the deputy chief-of-staff of the People’s Liberation Army confirmed China was developing new aircraft carriers that would be much larger and more capable than the old Soviet design.

Little is known about ‘Project 002’. The South China Morning Post says work began on the ship in 2015, in the Shanghai Jiangnan Changxingdao shipyard.

It will be much larger. It may even be nuclear powered.

One detail, however, has been revealed.

Beijing state media reports military officials as saying 002, China’s third carrier, will feature catapults.

“In other words, 002 is entirely different from the Liaoning (001) and 001A, and it will look like a US aircraft carrier rather than a Russian one,” Li said.

Defence analysts have pointed to a series of recent satellite photographs revealing simulated carrier flight decks at several PLA facilities....

Changes noted in the shapes of these simulated decks may indicate an evolution of thinking as to how facilities and spaces should be arranged in future ships. This includes the recent addition of two parallel catapults.

Whether or not these are traditional steam-powered or advanced electromagnetic systems remains a matter for debate.

Either one would represent a significant boost to the size and weight of aircraft capable of being operated from China’s aircraft carriers.<sup>81</sup>

A February 21, 2017, press report stated:

China is looking into catapult technology, [Li Jie, a naval military expert] said, and the technology will likely be adopted on the 002, China’s third aircraft carrier, which is being built in Shanghai.

"In other words, 002 is entirely different from the Liaoning (001) and 001A, and it will look like US aircraft carrier rather than a Russian one," Li said.

Most advanced aircraft carriers use the Electromagnetic Catapult System, or Electromagnetic launcher (EML), to launch carrier-based jets, but China is still testing steam catapults, Li said. "The main difference is that EMLs are more flexible and the system's speed can be controlled, so it can launch aircraft of different sizes."

[Yin Zhuo, a senior researcher at the PLA Navy Equipment Research Center] said "in order to protect China's territories and overseas interests, China needs two carrier strike groups in the West Pacific Ocean and two in the Indian Ocean. So we need at least five to six aircraft carriers."<sup>82</sup>

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<sup>81</sup> Jamie Seidel, “China Is About to Launch Its Second Aircraft Carrier, 001A,” *News.com.au*, March 6, 2017.

<sup>82</sup> Yang Sheng, “2<sup>nd</sup> Carrier Almost Complete,” *Global Times*, February 21, 2017. See also Robert Farley, “China’s Under-Construction Aircraft Carrier Isn’t the One to Worry About, It’s The One That Comes After,” *War Is Boring*, November 5, 2016; Eric Tegler, “China Wants to Launch Carrier Fighters Just Like the U.S. Navy,” *Popular Mechanics*, September 27, 2016; Mike Yeo, “China Experimenting With Catapult Launched Carrier Aircraft,” *USNI News*, September 22, 2016; Richard D. Fisher Jr., “China Flight Testing Modified J-15 for CATOBAR Operations,” *IHS Jane’s 360*, September 20, 2016; Jeffrey Lin and P.W. Singer, “The Next Generation of China’s Carrier-Borne Fighter, The Flying Shark, Takes to the Skies,” *Popular Science*, September 20, 2016; Andrew Tate, “China’s Third (continued...) ”

### Carrier-Based Aircraft

China has developed a carrier-capable fighter, called the J-15 or Flying Shark, that can operate from the *Liaoning* (**Figure 8**). 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.”<sup>83</sup>

**Figure 8. 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.

A November 10, 2014, trade press report states that “China has put the Shenyang J-15 Flying Shark carrier-borne multirole fighter into serial production, with at least eight production examples known to be flying already. This is in addition to the six J-15 prototypes, some of which conducted carrier trials on board China’s refurbished former Soviet Kuznetsov-class carrier, *Liaoning*.”<sup>84</sup>

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(...continued)

Aircraft Carrier Likely to be Fitted with Catapults,” IHS Jane’s *Defence Weekly*, August 4, 2016.

<sup>83</sup> 2014 DOD CMSD, p. 68. See also 2015 ONI Report, p. 23.

<sup>84</sup> Mike Yeo, “Chinese Carrier Fighter Now In Serial Production,” *USNI News* (<http://news.usni.org>), November 10, 2014. See also “J-15 Carrier-Based Fighter Modified for Catapult Launch,” *Want China Times* ([www.wantchinatimes.com](http://www.wantchinatimes.com)), November 3, 2014. See also David Axe, “Is China Sending a Stealth Fighter to Sea? J-31 Mock-Up Appears on Carrier Deck,” *Real Clear Defense* ([www.realcleardefense.com](http://www.realcleardefense.com)), October 1, 2014.

A May 13, 2015, press report states that China has begun development of a short takeoff, vertical landing (STOVL) aircraft that could operate from a ship.<sup>85</sup>

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.<sup>86</sup>

A May 1, 2017, press report states:

The improved J-31 stealth fighter prototype has been ramping up its test flights in April 2017, adding fuel to speculation that it will become the stealth fighter for Chinese aircraft carriers....

There's been talk on Chinese Internet messaging boards suggesting that SAC [Shenyang Aircraft Corporation, builder of the J-31] has recently won government funding for a J-31 carrier version, which could be larger than the initial prototypes (the carrier capable F-35C is also larger than the basic F-35A variant), in order to increase range, payload, and structural strength for the stress of carrier flight operations.<sup>87</sup>

### ***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 symbolize 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.<sup>88</sup> Chinese aircraft carriers could also be used for humanitarian assistance and disaster relief (HA/DR) operations, maritime security operations (such as anti-piracy operations), and non-combatant 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,<sup>89</sup> but conducting such attacks could divert U.S. ships and aircraft from performing other missions in a conflict situation with China.<sup>90</sup>

<sup>85</sup> "Nation Starts Research on Naval Jet," *Chinamil.com*, May 13, 2015.

<sup>86</sup> Anki Panda, "An Early Warning Aircraft for China's Carriers?" *The Diplomat*, February 1, 2017.

<sup>87</sup> Jeffrey Lin and P.W. Singer, "China's J-31 Stealth Fighter Gets An Improved Prototype—and a Potential Future on a Carrier," *Popular Science*, May 1, 2017.

<sup>88</sup> 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](http://www.realcleardefense.com)), April 10, 2014.

<sup>89</sup> See, for example, James Holmes, "Revealed: How the US Navy Would Destroy a Chinese Aircraft Carrier," *Asia Times*, May 31, 2016.

<sup>90</sup> 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.



DOD states that

LIAONING will possibly be used for fleet air defense missions, extending air cover over a fleet operating far from land-based coverage. Although it possesses a full suite of weapons and combat systems, LIAONING will probably continue to play a significant role in training China's carrier pilots, deck crews, and developing tactics that will be used with later, more capable carriers."<sup>91</sup>

DOD also states that

Operating its first carrier LIAONING has provided the PLAN valuable lessons, serving in what officials describe as an "experimental" capacity, that the PLA states will be applied to a future multi-carrier force.... China's next generation of carriers will probably be capable of improved endurance and of launching more varied types of aircraft, including EW, early warning, and anti-surface warfare (ASW), thus increasing the potential striking power of a PLAN "carrier battle group" in safeguarding China's interests in areas beyond its immediate periphery. The carriers would most likely perform such missions as patrolling economically important sea lanes, conducting naval diplomacy, regional deterrence, and HA/DR.<sup>92</sup>

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.<sup>93</sup>

A March 3, 2016, press report states:

China is building aircraft carrier battlegroups and plans to deploy them not only in the disputed East and South China seas, but also to protect the country's overseas interests.

Rear Admiral Yin Zhuo, who served as a national political adviser and sits on the navy's advisory board on cybersecurity, told the state-run Xinhua News Agency that building aircraft carriers served to "defend China's sovereignty of the islands and reefs, maritime rights and overseas -interests".

The defence ministry confirmed this year that China was building its second aircraft carrier, its first wholly home-made one.

Xinhua mentioned China's growing interests overseas, including the increasing numbers of nationals travelling abroad and its direct investments. It also noted a need to protect overseas ethnic Chinese.

"Protecting the economic, political status and occupational safety of overseas Chinese is paramount to safeguarding China's domestic economic development and its reform and opening-up," Yin said, adding that such protection required strong naval power like aircraft carrier battlegroups.<sup>94</sup>

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<sup>91</sup> 2016 DOD CMSD, p. 28.

<sup>92</sup> 2016 DOD CMSD, p. 68. See also Bryan McGrath, "Why China Wants Aircraft Carriers," *National Interest*, June 9, 2015. For an additional discussion of Chinese efforts to acquire aircraft carriers and develop naval aviation, see Andrew Erickson, "A Work in Progress: China's Development of Carrier Strike," *Jane's Navy International* (<https://janes.ihs.com>), June 19, 2014.

<sup>93</sup> 2015 ONI Report, p. 23.

<sup>94</sup> Zhen Liu, "China Plans Aircraft Carrier Battlegroups To Protect Offshore Interests," *South China Morning Post*, March 3, 2016.

A January 4, 2016, press report states:

China's second aircraft carrier, which is now under construction, will focus on military operations rather than training and technological experiments, according to a senior military researcher.

"This carrier will have different missions than those for the Liaoning (the country's first aircraft carrier)," Senior Captain Zhang Junshe with the People's Liberation Army Naval Military Studies Research Institute told the official PLA Daily on Friday.

"We use the Liaoning to test the reliability and compatibility of systems on carriers, and to train personnel. The second carrier will mainly do what a genuine aircraft carrier is supposed to do: running combat patrols and delivering humanitarian aid."

Zhang said China urgently needs a second carrier, as the country is seeking to improve its defense systems and better safeguard national interests.

"The PLA needs at least three aircraft carriers. When it does, one can be on duty, one can train personnel, and the third can receive maintenance," he said.<sup>95</sup>

## **Navy Surface Combatants and Coast Guard Cutters**

### *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 "since 2008, the PLAN has continued a robust surface combatant construction program of various classes of ships, including guided-missile destroyers (DDG) and guided-missile frigates (FFG),"<sup>96</sup> and that "these new DDGs and FFGs provide a significant upgrade to the PLAN's air defense capability, which will be critical as it expands operations into distant seas beyond the range of shore-based air defense systems."<sup>97</sup> 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.<sup>98</sup>

China is also building a new class of corvettes (i.e., light frigates) and has put into service a new kind of missile-armed fast attack craft that uses a stealthy catamaran hull design. China also is building a new cruiser (or large destroyer). 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."<sup>99</sup>

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

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<sup>95</sup> Zhang Tao, "2<sup>nd</sup> Aircraft Carrier To Have Military Focus," *China Daily*, January 4, 2016.

<sup>96</sup> 2016 DOD CMSD, p. 26.

<sup>97</sup> 2016 DOD CMSD, p. 26.

<sup>98</sup> 2015 ONI Report, p. 15.

<sup>99</sup> 2015 ONI Report, p. 13.

that that could operate with part or most of their hulls below the waterline so as to reduce their detectability.<sup>100</sup>

China is also building substantial numbers of new cutters for the China Coast Guard (CCG), a paramilitary service that 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 non-commercial shipbuilding.

Russia reportedly has assisted China's development of new surface warfare capabilities.<sup>101</sup>

### *New Type 055 Cruiser (or Large Destroyer)*

China is building a new cruiser (or large destroyer), called the Type 055 (see the unofficial and not entirely consistent renderings in **Figure 9** and the lower half of **Figure 10**), that reportedly might displace roughly 10,000 tons to 12,000 tons.

**Figure 9. Type 055 Cruiser (or Large Destroyer)**

Unofficial rendering

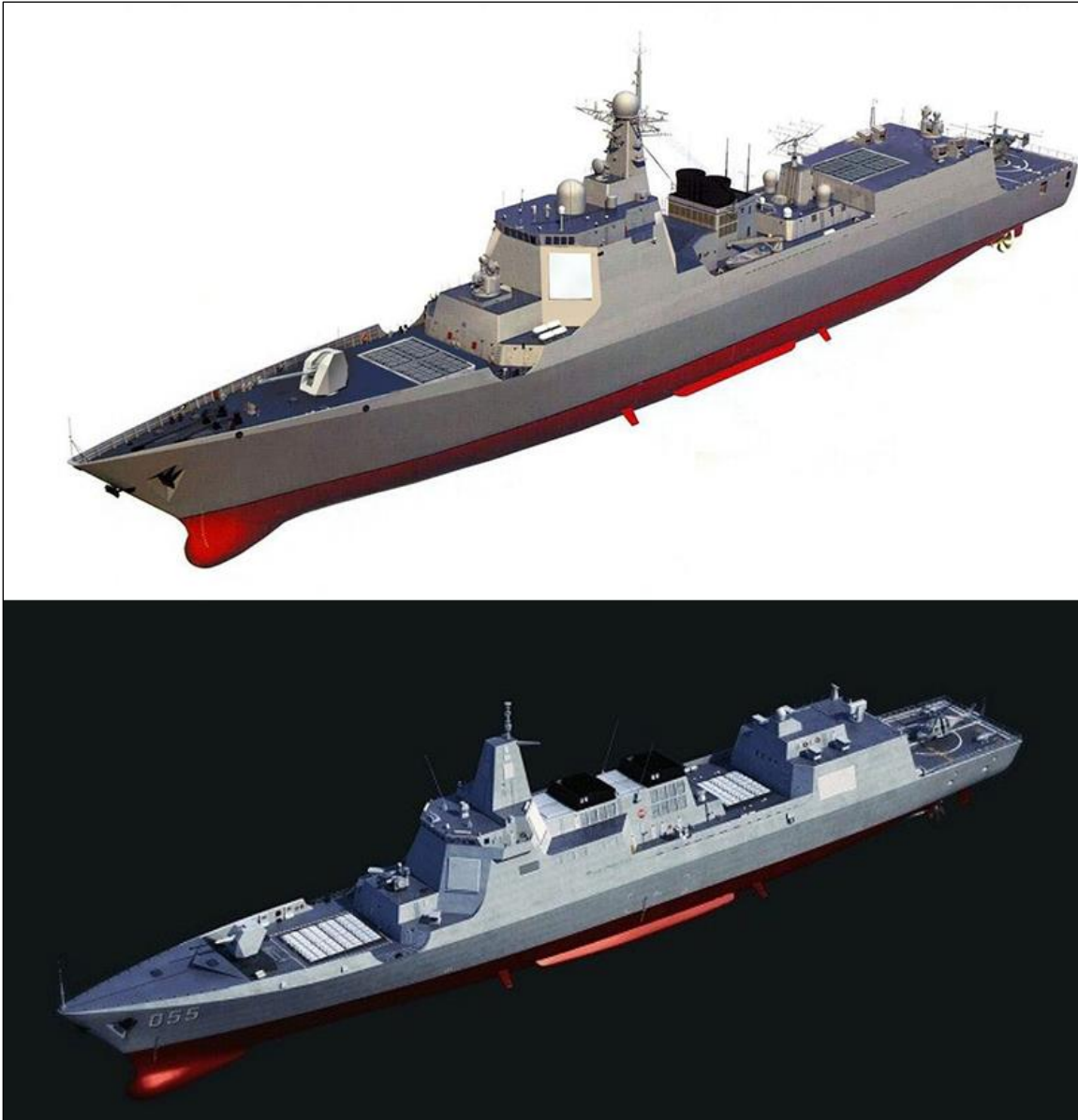


**Source:** Jeffrey Lin and P.W. Singer, "China's Largest Surface Warship Takes Shape," *Popular Science*, October 20, 2016.

<sup>100</sup> 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 available from the author).

<sup>101</sup> 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.

**Figure 10. Type 052D Destroyer and Type 055 Cruiser (or Large Destroyer)**  
Unofficial renderings of Type 052D (above) and Type 055 (below)



**Source:** Rendering captioned “The above illustrations clearly show the similarities and differences in the Type 052D (top) and Type 055 (bottom) guided missile destroyers.,” published as part of Brian Kalman, “New Arms Race: China Develops its Naval Power, Launches Type 055 Destroyer. Analysis,” *Global Research*, February 2, 2017.

China is the only country known to be planning to build a ship referred to (by some sources at least) as a cruiser.<sup>102</sup> (The U.S. Navy’s current 30-year shipbuilding plan includes destroyers but

<sup>102</sup> 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.

no cruisers.) DOD states that China has “probably begun construction of a larger Type 055 “destroyer,” a vessel better characterized as a guided-missile cruiser (CG) than a DDG.”<sup>103</sup> ONI states that “a new cruiser to be built in China in the latter half of the decade will carry a variety of antisurface weapons, some of which will be newly developed.”<sup>104</sup>

### *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 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 Luhū (Type 052A), Luhai (Type 051B), Louzhou (Type 051C), Luyang I (Type 052B), Luyang II (Type 052C), and Luyang III (Type 052D) designs. 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 11**) and the Luyang III-class ships 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.

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 shipyard<sup>105</sup>—commissionings of new Luyang II- and Luyang III-class destroyers resumed.

The first three Luyang III-class DDGs reportedly entered service in March 2014, August 2015, and December 2014.<sup>106</sup> The fourth and fifth reportedly entered service July 2016 and January

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<sup>103</sup> 2016 DOD CMSD, p. 26.

<sup>104</sup> 2015 ONI Report, p. 16. See also Brian Kalman, “New Arms Race: China Develops its Naval Power, Launches Type 055 Destroyer. Analysis,” *Global Research*, February 2, 2017; Kyle Mizokami, “China’s New Guided Missile Destroyer To Be Its Biggest Yet,” *Popular Mechanics*, October 24, 2016; Jeffrey Lin and P.W. Singer, “China’s Largest Surface Warship Takes Shape,” *Popular Science*, October 20, 2016; Zhang Tao, “Expert: 10,000-Ton-Class China-Made Destroyer to Escort CTO Aircraft Carrier,” *China Military*, September 6, 2016; Lyle J. Goldstein, “Can China’s ‘Dreadnought’ Tip the Naval Balance?” *National Interest*, March 19, 2016.; James C. Bussert, “China Develops Aircraft Carrier Group leader,” *Signal*, November 2015: 24-27.

<sup>105</sup> 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>.)

<sup>106</sup> “New Missile Destroyer Joins South China Sea Fleet,” *China Military Online*, December 14, 2015.



2017.<sup>107</sup> Observers in 2015 anticipated a total production run of 10 or 12 Type 052D ships.<sup>108</sup> A December 25, 2016, blog post, however, states:

Basically, we have a full flotilla of 4 052Ds in service with South Sea Fleet and another one that is about to join service. Aside from that, at least 2 more 052Ds are on sea trials and another 4 are fitting out at the shipyards (2 at Dalian and 2 at JN). The 052D production run seems to already have reached more units than I expected (which was 12).<sup>109</sup>

**Figure 11. Luyang II (Type 052C) Class Destroyer**



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

<sup>107</sup> Zhao Lei, “New ‘Carrier Killer’ Delivered to Fleet,” *China Daily*, January 24, 2017; Andrew Tate, “Fourth Type 052D Destroyer Joins China’s South Sea Fleet,” *IHS Jane’s 360*, July 14, 2016.

<sup>108</sup> See Franz-Stefan Gady, “China Commissions Second ‘Carrier Killer Destroyer,’” *The Diplomat*, July 27, 2015; and 2015 Report to Congress of the U.S. China Economic and Security Review Commission, November 2015, p. 241.

<sup>109</sup> Feng, “Notable Things from 2016,” *China Air and Naval Power*, December 25, 2016.

**Table 2. PLA Navy Destroyer Commissionings**

Actual (1994-2016) and Projected (2017-2018)

	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							3	3	23
2017							1	1	24
2018							3	3	27

Source: IHS Jane's *Fighting Ships 2016-2017*, and previous editions.**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 12** shows a Jiangkai II-class ship.

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 has continued to produce the JIANGKAI II-class FFG (Type 054A), with 20 ships currently in the fleet and five in various stages of construction."<sup>110</sup> A June 14, 2016, press report states that the 24<sup>th</sup> and 25<sup>th</sup> Type 054A

<sup>110</sup> 2016 DOD CMSD, p. 26.

ships were launched (i.e., put into the water for the final stages of construction) in late May and early June, 2016.<sup>111</sup> 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.”<sup>112</sup>

**Figure 12. Jiangkai II (Type 054A) Class Frigate**



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

**Table 3** shows commissionings of new frigates since 1991.

<sup>111</sup> Andrew Tate, “More Surface Ships for the Chinese Navy,” *IHS Jane’s 360*, June 14, 2016.

<sup>112</sup> Feng, “Notable Things from 2016,” *China Air and Naval Power*, December 25, 2016.



**Table 3. PLA Navy Frigate Commissionings**

Actual (1991-2016) and Projected (2017)

	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	0	32
2015				4	4	36
2016				2	2	38
2017				2 <sup>a</sup>	2	40

**Source:** IHS Jane's Fighting Ships 2016-2017, and previous editions.

a. IHS Jane's Fighting Ships 2016-2017 states that a total of 30 Jiangkai II-class ships is expected.

### 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 13**). These ships are being built at a high annual rate in four shipyards; *IHS Jane's Fighting Ships 2016-2017* states that the first 8 ships were commissioned into service in 2013, followed by 10 more in 2014, 5 more in 2015, and 8 more projected for 2016, for a total of 31 through 2016. (The 31<sup>st</sup> was reportedly commissioned into service in January 2017.<sup>113</sup>) A December 25, 2016, blog post states that

Both [the] HP and HD shipyard[s] will move to other projects after the current batch [of Type 054 frigates] is completed. They have both been very active with Type 056

<sup>113</sup> Zhao Lei, "New Vessel Beefs Up PLA Navy Fleet," *China Daily*, January 21, 2017.

production, as have [the] Wuchang and LiaoNan shipyard[s]. At least 6 Type 056s have already joined service this year. Up to this point, at least 40 of them have at least been launched. About 12 to 13 Type 056s have been identified in both [the] HP and HD shipyard[s], with another 9+ have been identified in each of the other 2. There may be 60 Type 056s by the end of its production run.<sup>114</sup>

**Figure 13. 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.

DOD states that “the latest [Type 056] ships have been upgraded to 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.”<sup>115</sup>

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 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

<sup>114</sup> Feng, “Notable Things from 2016,” *China Air and Naval Power*, December 25, 2016.

<sup>115</sup> 2016 DOD CMSD, p. 26.

craft as well as some of the PLA(N)'s aging JIANGHU I-class (Type 053H) frigates (FF).<sup>116</sup>

### *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 14**), that uses a stealthy, wave-piercing, catamaran hull.<sup>117</sup> Each boat can carry eight C-802 ASCMs.

**Figure 14. 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.

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. ONI states:

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 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.<sup>118</sup>

<sup>116</sup> 2015 ONI Report, p. 17.

<sup>117</sup> 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.

<sup>118</sup> 2015 ONI Report, p. 17.

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 15** shows a picture of a CCG ship.

**Figure 15. 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.<sup>119</sup> DOD states that

China prefers to use its government-controlled, civilian maritime law enforcement agencies in maritime disputes, and uses the PLAN in an overwatch capacity in case of escalation. The enlargement and modernization of the China Coast Guard (CCG) forces will improve China's ability to enforce its maritime claims. The CCG is increasing its total force level at a rapid pace. Over the last five years, China has added more than 100 ocean-going patrol ships to the CCG to increase its capacity to conduct extended offshore operations and to replace old units. In the next decade, a new force of civilian law enforcement ships will afford China the capability to patrol more robustly its claims in the East China Sea and the South China Sea. Overall, the CCG's total force level is

<sup>119</sup> 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.



expected to increase by 25 percent. Some of these ships will have the capability to embark helicopters, a capability that only a few CCG ships currently have.<sup>120</sup>

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.<sup>121</sup>

## **Amphibious Ships and Potential Floating Sea Bases**

DOD states that

China continues to improve its ability to conduct and sustain amphibious operations through its fleet modernization and joint exercise programs. In 2015, the PLA staged three joint landing exercises that tested its capabilities, marking an increase in the complexity of its amphibious training....

In recent years, China has built four new YUZHAO-class amphibious transport docks (LPD). Each of these is capable of carrying up to four YUYI-class LCMA as well as four helicopters, more than 50 armored vehicles, and a large number of forces. It has also built several additional YUTING II-class tank landing ships, acquired two POMORNIK-class air-cushion utility landing craft (LCUA) from Ukraine, and is finishing construction of two additional LCUAs in China.

Additionally, as part of a push for greater civil-military integration, several exercises in 2015 featured the use of civilian ferries or roll-on/roll-off (RO/RO) vessels. The use of these civilian ferries and RO/RO vessels may increase PLA mobility but would be limited to non-combat support operations due to the need for port infrastructure.<sup>122</sup>

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

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<sup>120</sup> 2016 DOD CMSD, p. 69.

<sup>121</sup> 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.

<sup>122</sup> 2016 DOD CMSD, p. 92.



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 includes significant, and possibly prohibitive, political risk because it could galvanize pro-independence sentiment on Taiwan and generate international opposition.<sup>123</sup>

### *Yuzhao (Type 071) Amphibious Ship*

China has put into service a new class of amphibious ships called the *Yuzhao* or *Type 071 class* (Figure 16).

**Figure 16. 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.

The Type 071 design has an estimated displacement of more than 19,855 tons,<sup>124</sup> compared with about 15,900 tons to 16,700 tons for the U.S. Navy's Whidbey Island/Harpers Ferry (LSD-41/49) class amphibious ships, which were commissioned into service between 1985 and 1998, and

<sup>123</sup> 2016 DOD CMSD, pp. 89-90.

<sup>124</sup> Unless otherwise indicated, displacement figures cited in this report are full load displacements. *IHS Jane's Fighting Ships 2016-2017*, 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.

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. *IHS Jane's Fighting Ships 2016-2017* states that the first three ships in the class were commissioned into service in 2007, 2011, 2012, and 2016, that a fifth ship in the class is expected enter service in 2017.<sup>125</sup> DOD states that

Since 2005, China has built three large YUZHAO-class (Type 071) amphibious transport docks (LPD) with a fourth soon to enter service, providing considerably greater and more flexible capability for "far seas" operations than the older landing ships. The YUZHAO can carry up to four of the new YUYI-class air-cushion medium landing craft (LCMA) and four or more helicopters, as well as armored vehicles and marines for long-distance deployments. Additional YUZHAO construction is expected in the near-term....<sup>126</sup>

### ***Reported Construction of Type 075 (aka Type 081) Amphibious Assault Ship***

DOD states that construction of an "a follow-on amphibious assault ship that is not only larger [than the Type 071 design], but incorporates a full flight deck for helicopters," is "expected in the near term."<sup>127</sup> *IHS Jane's Fighting Ships 2016-2017* states that "There are reports that construction of a Type 081 LHD [amphibious assault ship] is under consideration. Although no details have been released, the ship could be of the order of 20,000 tonnes and may be based on the Type 071 hull."<sup>128</sup> By comparison, U.S. Navy LHD/LHA-type amphibious assault ships displace 41,000 to 45,000 tons.

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 17**) stating that the ship would have a displacement of 40,000 tons, and referred to the ship as the Type 075 (rather than Type 081) design. The press report stated:

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."...

<sup>125</sup> *IHS Jane's Fighting Ships 2016-2017*, p. 156.

<sup>126</sup> *2016 ONI Report*, p. 27.

<sup>127</sup> *2016 DOD CMSD*, p. 27. A similar statement appears in *2015 ONI Report*, p. 18.

<sup>128</sup> *IHS Jane's Fighting Ships 2016-2017*, p. 156.

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.”

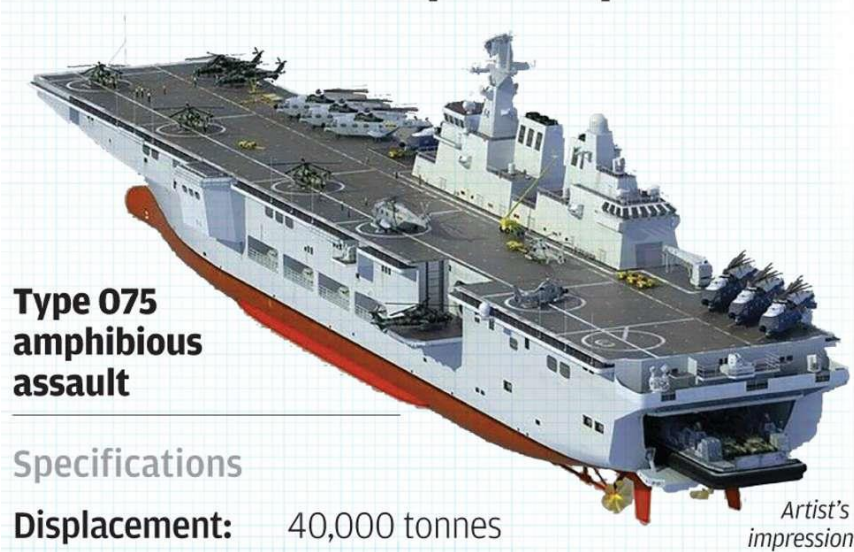
The Type 075 is able to deploy and house up to 30 armed helicopters. Six helicopters will be able to take off from the flight deck at the same time.

The vessels will also be able to deploy landing craft and troops, plus house command and control operations.<sup>129</sup>

**Figure 17. Type 075 (aka Type 081) 081 LHD**

Unofficial artist’s rendering

## China’s first helicopter ship



### Type 075 amphibious assault

#### Specifications

<b>Displacement:</b>	40,000 tonnes
<b>Length:</b>	250m
<b>Beam:</b>	30m
<b>Draft:</b>	8m
<b>Aircraft carried:</b>	30 armed helicopters in hanger; four helicopter elevators on deck
<b>Manufacturer:</b>	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.

<sup>129</sup> 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 081 Ships***

Although larger amphibious ships such as the Type 071 and the potential Type 081 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 anti-piracy operations), and non-combatant 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 "China's investments in its amphibious ship force signal China's intent to develop an expeditionary and over-the-horizon amphibious assault capability as well as HA/DR and counterpiracy capabilities."<sup>130</sup>

### ***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.<sup>131</sup>

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.<sup>132</sup>

### ***Ship Similar to U.S. Navy's Mobile Landing Platform (MLP) Ship***

In July 2015, it was reported that China's navy had commissioned into service a ship similar to the U.S. military's Mobile Landing Platform (MLP) ship. China's ship, like the U.S. MLP, 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 MLP-like ship, with an estimated displacement of about 20,000 tons, is smaller than the U.S. MLP.<sup>133</sup>

### ***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.<sup>134</sup>

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<sup>130</sup> 2016 DOD CMSD, p. 26. 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.

<sup>131</sup> 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.

<sup>132</sup> "Beijing Mass-Producing Amphibious Landing Craft," *China Post*, February 4, 2017.

<sup>133</sup> 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.

<sup>134</sup> Franz-Stefan Gady, "China Prepares Its 172,000 Civilian Ships for War," *The Diplomat*, June 23, 2015.



### Potential Floating Sea Bases

China reportedly is building or preparing to build one or more large floating sea bases. The bases (see **Figure 18**) 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.

**Figure 18. 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 10, 2015, press report states:

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 (VLSFs) 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.

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.<sup>135</sup>

An August 19, 2015, press report states:

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

<sup>135</sup> 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.



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.<sup>136</sup>

## **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 4<sup>th</sup>-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 4<sup>th</sup>- 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-

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<sup>136</sup> Luxioa Zou, “Two Chinese Companies to Build ‘Floating Fortresses,’” *People’s Daily Online*, August 19, 2015. See also Liang Jun, “China Displays Its First Large Floating Structure,” *People’s Daily Online*, July 30, 2015.

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 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.<sup>137</sup>

DOD states that

China is also producing bomber-class aircraft. China continues to upgrade its H-6 bomber fleet (originally adapted from the late-1950s Soviet Tu-16 design) to increase operational effectiveness and lethality by integrating new standoff weapons. The PLAAF operates three different H-6 bomber variants. The H-6H and the more capable H-6M have been in service since the last decade. The PLAAF also employs the new, fully redesigned H-6K variant with new turbofan engines for extended range and the capability to carry six LACMs. Converting the H-6 into a cruise missile carrier gives the PLA a long-range standoff offensive air capability with precision-guided munitions capable of striking Guam. In 2015, China flew H-6Ks into the western Pacific Ocean in a demonstration of the airframe's long-range capability. PLA Navy Aviation utilizes a nearly identical version of the earlier H-6, known as the H-6G equipped with systems and four weapons pylons for ASCMs to support maritime missions. All of China's H-6 variants maintain their traditional bomb bay for gravity bombs, precision guided bombs, and naval mines....

China is improving its airfields in the South China Sea with the availability of Woody Island Airfield in the Paracel Islands and construction of up to three new airfields in the Spratly Islands. All of these airfields could have runways long enough to support any aircraft in China's inventory. During late-October 2015 the PLAN deployed four of its most capable air superiority fighters, the J-11B, to Woody Island.<sup>138</sup>

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<sup>137</sup> 2015 ONI Report, pp. 21-22.

<sup>138</sup> 2016 DOD CMSD, p. 31.

## UAVs

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

the acquisition and development of longer-range UAVs will increase China's ability to conduct long-range ISR and strike operations. China is advancing its development and employment of UAVs. In 2015, Chinese 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. Last year, the PLAAF also reported on its use of a UAV to assist in HA/DR in the aftermath of an earthquake in China's west—the first public acknowledgment of PLAAF UAV operations. Photos of the UAV showed it was the Yilong (also known as the Wing Loong or Pterodactyl).<sup>139</sup>

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.<sup>140</sup>

## 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.'"<sup>141</sup>

## 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, and seabed sonar networks.<sup>142</sup> DOD states that

The PLAN also is improving its over-the-horizon (OTH) targeting capability with sky wave and surface wave over the horizon (OTH) radars, which can be used in conjunction with reconnaissance satellites to locate targets at great distances from China, ([t]hereby supporting long-range precision strikes, including employment of ASBMs.<sup>143</sup>

<sup>139</sup> 2016 DOD CMSD, pp. 62-63.

<sup>140</sup> 2015 ONI Report, pp. 22-23.

<sup>141</sup> Bill Gertz, "Beijing Develops Pulse Weapons," *Washington Times*, July 22, 2011: 1. Except for "[July 21]," materials in brackets as in original.

<sup>142</sup> See 2011 DOD CMSD, pp. 3 and 38; 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.

<sup>143</sup> 2016 DOD CMSD, p. 72. 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' (continued...)

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 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.

## 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.<sup>144</sup>

## Chinese Naval Operations Away from Home Waters

### General

Chinese navy ships in recent years have begun to conduct operations away from China's home waters, including the broader waters of the Western Pacific, the Indian Ocean, and the Mediterranean 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 in particular anti-piracy operations in waters off Somalia. China has been conducting anti-piracy operations in waters off Somalia since December 2008 via a succession of rotationally deployed naval escort task forces.

DOD states that “China continues its gradual shift from ‘near sea’ defense to ‘far seas’ protection as espoused in its most recent DWP [defense white paper], with the PLAN conducting operational

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(...continued)

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](http://www.taipeitimes.com)), October 2, 2014.

<sup>144</sup> 2015 ONI Report, p. 24.

tasks outside the so-called ‘first island chain’ with multi-mission, long-range, sustainable naval platforms that have robust self-defense capabilities,<sup>145</sup> and that

China’s maritime emphasis and attention to missions guarding its overseas interests has increasingly drawn the PLA beyond China’s borders and its immediate periphery. The PLA Navy’s evolving focus—from “offshore waters defense” to a mix of “offshore waters defense” and “open seas protection”—reflects the high command’s expanding interest in a wider operational reach.<sup>146</sup>

DOD also states that

In the last several years, the PLAN’s “far seas” experience has been derived primarily from its ongoing counterpiracy mission in the Gulf of Aden and long-distance task group deployments beyond the first island chain in the western Pacific Ocean. China continues to sustain a three-ship presence in the Gulf of Aden to protect Chinese merchant shipping from maritime piracy. This operation is China’s first enduring naval operation beyond the Asia-Pacific region.

In 2015, the PLAN continued to conduct “far seas” deployments. The PLAN continued submarine deployments to the Indian Ocean, demonstrating its increasing familiarity with operating in that region. Following a China-Russia naval exercise in 2015, three PLAN ships transited the Bering Sea and U.S. territorial waters near Alaska’s Aleutian Islands. In 2015, a three-ship counterpiracy task group followed their three month deployment to the Indian Ocean with a round-the-world cruise visiting numerous ports in Europe, Central America, and the United States.

The PLAN’s force structure continues to evolve, incorporating more platforms with the versatility for both offshore and long-distance power projection.<sup>147</sup>

DOD also states that

A PLAN task force conducted a cruise around the world from August 2015 to February 2016, during which it conducted bilateral training with Denmark. Ships from the 20th Naval Escort Task Force in the Gulf of Aden stopped in 13 countries, including Poland, Cuba, Sweden, the United States, Denmark, and Australia. This is the first PLAN operation to circumnavigate the globe since 2002, building on more recent naval visits to Africa and Europe.<sup>148</sup>

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

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<sup>145</sup> 2016 DOD CMSD, pp. 25-26.

<sup>146</sup> 2016 DOD CMSD, p. 44. See also p. 57.

<sup>147</sup> 2016 DOD CMSD, p. 69.

<sup>148</sup> 2016 DOD CMSD, p. 21. See also Andrew Poulin, “Going Blue: The Transformation of China’s Navy,” *The Diplomat*, April 15, 2016.



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.<sup>149</sup>

A March 9, 2016, press report states:

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 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.<sup>150</sup>

A March 29, 2017, press report states:

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.<sup>151</sup>

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<sup>149</sup> 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.

<sup>150</sup> Andrew S. Erickson and Christopher P. Carlson, "Sustained Support: the PLAN Evolves Its Expeditionary Logistics Strategy," *IHS Jane's Navy International*, March 9, 2016.

<sup>151</sup> Jeffrey Lin and P.W. Singer, "China's Marine Corps Is Getting Bigger and Stronger," *Popular Science*, March 29, (continued...)

A May 18, 2017, blog post states:

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 ability to project power and gain air superiority beyond the mainland to support naval operations.<sup>152</sup>

## Bases Outside China

Observers for years have speculated and debated whether, where, and when China might build bases or other logistic support facilities to support Chinese naval operations outside China's near-seas region, and particularly along the sea line of communication linking China to Persian Gulf oil sources.<sup>153</sup> DOD states 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."<sup>154</sup> 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.<sup>155</sup>

In November and December 2015, it was reported 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.<sup>156</sup>

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(...continued)

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.

<sup>152</sup> Eli Huang, "China's PLAN—Breaking Out to Blue Waters," *Australian Strategic Policy Institute*, May 18, 2017.

<sup>153</sup> Bill Gertz, "China Builds Up Strategic Sea Lanes," *Washington Times*, January 18, 2005, p.1. See also Daniel J. Kostecka, "The Chinese Navy's Emerging Support Network in the Indian Ocean," *China Brief*, July 22, 1010: 3-5; Edward Cody, "China Builds A Smaller, Stronger Military," *Washington Post*, April 12, 2005, p. 1; Indrani Bagchi, "China Eyeing Base in Bay of Bengal?" *Times of India*, August 9, 2008, posted online at [http://timesofindia.indiatimes.com/China\\_eyeing\\_base\\_in\\_Bay\\_of\\_Bengal/articleshow/3343799.cms](http://timesofindia.indiatimes.com/China_eyeing_base_in_Bay_of_Bengal/articleshow/3343799.cms); Eric Ellis, "Pearls for the Orient," *Sydney Morning Herald*, July 9, 2010.

<sup>154</sup> 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.

<sup>155</sup> Ben Blanchard, "China Hints More Bases On Way After Djibouti," *Reuters*, March 8, 2016.

<sup>156</sup> See, for example, Jane Perlez, "U.S. Casts Wary Eye on Australian Port Leased by Chinese," *New York Times*, (continued...)

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.<sup>157</sup>

DOD states that

China is expanding its access to foreign ports to pre-position the necessary logistics support to regularize and sustain deployments in the “far seas,” waters as distant as the Indian Ocean, Mediterranean Sea, and Atlantic Ocean. In late November, China publicly confirmed its intention to build military supporting facilities in Djibouti “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 Chinese initiative both reflects and amplifies China’s growing geopolitical clout, extending the reach of its influence and armed forces.

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

-- China most likely will seek to establish additional naval logistics hubs in countries with which it has a longstanding friendly relationship and similar strategic interests, such as Pakistan, and a precedent for hosting foreign militaries. China’s overseas naval logistics aspiration may be constrained by the willingness of countries to support a PLAN presence in one of their ports.

So far, China has not constructed U.S.-style overseas military bases in the Indian Ocean. China’s leaders may judge instead that a mixture of 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 logistics needs to support its evolving naval requirements.

-- Preferred access would give the PLAN favored status in using a commercial port for resupply, replenishment, and maintenance purposes. A logistics facility would represent an arrangement in which China leases out portions of a commercial port solely for PLAN logistics operations.

-- Such a logistics presence may support both civilian and military operations. China’s current naval logistics footprint in the Indian Ocean is unable to support major combat operations in South Asia.

A greater overseas naval logistics footprint would better position the PLAN to expand its participation in non-war military missions, such as non-combatant evacuation operations (NEO), search-and-rescue (SAR), humanitarian assistance/disaster relief (HA/DR), and sea lines of communication (SLOC) security. To some extent, a more robust overseas logistics presence may also enable China to expand its support to PKO, force protection missions, and counterterrorism initiatives.

For example, in 2015, the PLAN’s naval escort task forces performing counterpiracy escort duties in the Gulf of Aden were able to utilize Djibouti and Oman for basic resupply and replenishment.<sup>158</sup>

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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.

<sup>157</sup> “China May Deploy Marines to Gwadar Port,” *Maritime Executive*, March 16, 2017.

<sup>158</sup> 2016 DOD CMSD, p. 6. See also Brendan Thomas-Noone, “The Master Plan: Could This Be China’s Overseas (continued...) ”

## 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”;<sup>159</sup> 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”;<sup>160</sup> and that
- “currently, the [PLA(N)] submarine force consists of five nuclear attack submarines, four nuclear ballistic missile submarines, and 57 diesel attack submarines.”<sup>161</sup>

#### *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.

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Basing Strategy?” *National Interest*, November 6, 2014. See also 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 (Center for the Study of Chinese Military Affairs, Institute for National Strategic Studies, National Defense University), 45 pp. See also S. Kulshrestha, “Jade Necklace: Naval Dimension of Chinese Engagement with Coastal Nations Across the Oceans,” *IndraStra*, December 17, 2017.

<sup>159</sup> 2015 ONI Report, p. 13.

<sup>160</sup> 2015 ONI Report, p. 15.

<sup>161</sup> 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
<b>Numbers</b>					
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
<b>Approximate percent of modern design</b>					
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
<b><i>Ships</i></b>							
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
<b>Subtotal above ships</b>	<b>130</b>	<b>136</b>	<b>124</b>	<b>127</b>	<b>136</b>	<b>~146 or ~147?</b>	<b>~146 or ~147?</b>
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
<b><i>Aircraft</i></b>							
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
<b>Subtotal above aircraft</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>~179</b>	<b>~468</b>	<b>~505</b>

**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 now possesses the largest number of vessels in Asia, with more than 300 surface ships, submarines, amphibious ships, and patrol craft,”<sup>162</sup> and that “in 2015, the PLA Navy had the largest force of principal combatants, submarines, and amphibious warfare ships in Asia.”<sup>163</sup> **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.<sup>164</sup>

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<sup>162</sup> 2016 DOD CMSD, p. 25.

<sup>163</sup> 2016 DOD CMSD, p. 108.

<sup>164</sup> 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
Ballistic missile submarines	1	1	1	n/a	1	1	1	1	2	2	2	2	3	3	4	4
Nuclear-powered attack submarines	5	5		n/a	6	5	5	5	6	6	5	5	5	5	5	5
Diesel attack submarines	~60	~ 50	~60	n/a	51	50	53	54	54	54	49	48	49	51	53	57
Aircraft carriers	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Destroyers	~20			n/a	21	25	25	29	27	25	26	26	23	24	21	23
Frigates	~40	~ 60	> 60	n/a	43	45	47	45	48	49	53	53	52	49	52	52
Corvettes	0	0	0	0	0	0	0	0	0	0	0	0	0	8	15	23
Missile-armed coastal patrol craft	n/a	~ 50	~ 50	n/a	51	45	41	45	70	85	86	86	85	85	86	86
Amphibious ships: LSTs and LPDs	almost 50	~ 40	> 40	n/a	20	25	25	26	27	27	27	28	29	29	29	30
Amphibious ships: LSMs				n/a	23	25	25	28	28	28	28	23	26	28	28	22

**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,<sup>165</sup> 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.**<sup>166</sup> 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.<sup>167</sup> 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

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<sup>165</sup> 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.

<sup>166</sup> 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).

<sup>167</sup> 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:

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.<sup>168</sup>

## **DOD Response to China Naval Modernization**

### **Efforts to Preserve U.S. Military Superiority**

DOD 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, including the following:

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<sup>168</sup> 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.

- **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.<sup>169</sup>
- **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.<sup>170</sup>
- **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.”<sup>171</sup>
- **Third Offset Strategy.** DOD has also announced that it is 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.<sup>172</sup> A December 5, 2016, press report

<sup>169</sup> 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.

<sup>170</sup> 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 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>.

<sup>171</sup> Cheryl Pellerin, “DoD Seeks Novel Ideas to Shape Its Technological Future,” *DoD News*, February 24, 2015.

<sup>172</sup> 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; (continued...)

suggests that the Third Offset Strategy includes something called “The China Strategic Initiative.”<sup>173</sup>

## U.S. Strategic Rebalancing to Asia-Pacific Region

As mentioned earlier, a 2012 DOD strategic guidance document<sup>174</sup> and DOD’s report on the 2014 Quadrennial Defense Review (QDR)<sup>175</sup> 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.

## Asia-Pacific Maritime Security Strategy

As one reflection of the U.S. strategic rebalancing to the Asia-Pacific region, a DOD report on Asia-Pacific maritime security strategy submitted to Congress in August 2015 states, in discussing “DoD lines of effort,” that

*First, we are strengthening our military capacity to ensure the United States can successfully deter conflict and coercion and respond decisively when needed. The Department is investing in new cutting-edge capabilities, deploying our finest maritime capabilities forward, and distributing these capabilities more widely across the region. The effort also involves enhancing our force posture and persistent presence in the region, which will allow us to maintain a higher pace of training, transits, and operations. The United States will continue to fly, sail, and operate in accordance with international law, as U.S. forces do all around the world.*

*Second, we are working together with our allies and partners from Northeast Asia to the Indian Ocean to build their maritime capacity. We are building greater interoperability, updating our combined exercises, developing more integrated operations, and cooperatively developing partner maritime domain awareness and maritime security*

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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.

<sup>173</sup> 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.)

<sup>174</sup> Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21<sup>st</sup> 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)

<sup>175</sup> 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)

capabilities, which will ensure a strong collective capacity to employ our maritime capabilities most effectively.

*Third, we are leveraging military diplomacy to build greater transparency, reduce the risk of miscalculation or conflict, and promote shared maritime rules of the road.* This includes our bilateral efforts with China as well as multilateral initiatives to develop stronger regional crisis management mechanisms. Beyond our engagements with regional counterparts, we also continue to encourage countries to develop confidence-building measures with each other and to pursue diplomatic efforts to resolve disputed claims.

*Finally, we are working to strengthen regional security institutions and encourage the development of an open and effective regional security architecture.* Many of the most prevalent maritime challenges we face require a coordinated multilateral response. As such, the Department is enhancing our engagement in ASEAN-based institutions such as the ASEAN Defense Ministers Meeting Plus (ADMM-Plus), ASEAN Regional Forum (ARF), and the Expanded ASEAN Maritime Forum (EAMF), as well as through wider forums like the Western Pacific Naval Symposium (WPNS) and Indian Ocean Naval Symposium (IONS), which provide platforms for candid and transparent discussion of maritime concerns.<sup>176</sup>

Obama Administration officials stated that notwithstanding constraints on U.S. defense spending under the Budget Control Act of 2011 (S. 365/P.L. 112-25 of August 2, 2011) as amended, DOD will seek to protect initiatives for strengthening U.S. military presence and capabilities in the Asia-Pacific region. Some observers, viewing both the BCA's constraints on defense spending and events in Europe (i.e., Russia's actions in Ukraine) and in the Middle East (U.S. efforts to counter the Islamic State organization) that have drawn U.S. policymaking attention back to those two regions, have questioned whether DOD should, or will be able to, fully implement its initiatives for the Asia-Pacific region.<sup>177</sup>

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

DOD has been developing a concept, originally called Air-Sea Battle (ASB) and now called Joint Concept for Access and Maneuver in the Global Commons (JAM-GC),<sup>178</sup> 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 state 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 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:

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<sup>176</sup> Department of Defense, *Asia-Pacific Maritime Security Strategy*, undated but released August 2015, pp. 19-20. Italics as in original. The report was submitted in response to Section 1259 of the Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015 (H.R. 3979/P.L. 113-291 of December 19, 2014).

<sup>177</sup> See, for example, Connor O'Brien, "U.S. Should Reconsider Asia-Pacific 'Pivot,' Former NATO Commander Says," *Politico*, February 10, 2016.

<sup>178</sup> 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 Melds 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.

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....<sup>179</sup>

## **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 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 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....

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<sup>179</sup> Justin Doubleday, "Draft DOD Joint Concept Nearing Completion, Getting Input From Services, COCOMs," *Inside the Pentagon*, January 6, 2016.



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.<sup>180</sup>

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.”<sup>181</sup>
- 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 states 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.<sup>182</sup>
- 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.<sup>183</sup>
- The Navy will increase the number of attack submarines homeported at Guam to four, from a previous total of three.<sup>184</sup>

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<sup>180</sup> John Richardson, *The Future Navy*, May 17, 2017, pp. 1-3, 9.

<sup>181</sup> U.S. Department of Defense, *Quadrennial Defense Review Report*. Washington, 2006. (February 6, 2006) p. 47.

<sup>182</sup> Victor Battle, “US Navy ‘Shaping Events’ in South China Sea,” *VOA News* ([www.voanews.com](http://www.voanews.com)), May 20, 2014. See also Mike McCarthy, “CNO Sees More Integration With Asian Allies,” *Defense Daily*, May 20, 2014: 1-2.

<sup>183</sup> See, for example, Richard Sisk, “All Three Zumwalt Class Destroyers to Be Assigned to Pacific: Carter,” *Military.com*, April 8, 2016.

<sup>184</sup> “Fourth Attack Sub to be Homeported in Guam,” *Navy News Service*, February 10, 2014.

- The Navy has announced an intention to station up to four Littoral Combat Ships (LCSs) at Singapore by 2017,<sup>185</sup> and an additional seven LCSs in Japan by 2022.<sup>186</sup>
- In April 2014, the United States and the Philippines signed an agreement that was to provide U.S. forces with increased access to Philippine bases.<sup>187</sup>
- 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 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 increase the number of U.S. Navy ships operating in the Western Pacific.<sup>188</sup> In April, May, and June 2016, the Navy announced that it had begun doing this.<sup>189</sup>

In addition to the above actions, U.S. Marines have begun 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).<sup>190</sup>

### 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).

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<sup>185</sup> 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* ([www.foreignpolicy.com](http://www.foreignpolicy.com)), November 14, 2012.

<sup>186</sup> Zachary Keck, “U.S. Chief of Naval Operations: 11 Littoral Combat Ships to Asia by 2012,” *The Diplomat* (<http://thediplomat.com>), May 17, 2013.

<sup>187</sup> See, for example, Mark Landler, “U.S. and Philippines Agree to a 10-Year Pact on the Use of Military Bases,” *New York Times*, ([www.nytimes.com](http://www.nytimes.com)), April 27, 2014; Associated Press, “Obama Says US-Philippines Military Pact Will Improve Asia’s Security,” *Fox News* ([www.foxnews.com](http://www.foxnews.com)), April 28, 2014; Luis Ramirez, “US-Philippines Defense Deal to Improve Asia Security,” *VOA News* ([www.voanews.com](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* ([www.reuters.com](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.

<sup>188</sup> Tim Kelly, “U.S. Admiral Signals Wider Role for Powerful Third Fleet in Western Pacific,” *Reuters*, September 26, 2015.

<sup>189</sup> See “USS Momsen Departs on Pacific Surface Action Group Deployment,” *Navy News Service*, April 18, 2016; Audrey McAvoy, “US Pacific Fleet Expands Use of 3<sup>rd</sup> 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 3<sup>rd</sup> 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.

<sup>190</sup> 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.

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,<sup>191</sup> Virginia (SSN-774) class attack submarines,<sup>192</sup> and Arleigh Burke (DDG-51) class Aegis destroyers.<sup>193</sup> Examples of highly capable aircraft now being acquired by the Navy include F-35C carrier-based Joint Strike Fighters (JSFs),<sup>194</sup> F/A-18E/F Super Hornet strike fighters and EA-18G Growler electronic attack aircraft,<sup>195</sup> E-2D Hawkeye early warning and command and control aircraft, and the P-8A Multi-mission Maritime Aircraft (MMA).<sup>196</sup> 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,<sup>197</sup> as well as the electromagnetic rail gun (EMRG), solid state lasers (SSLs), and a hypervelocity projectile (HPV) for the 5-inch guns on Navy cruisers and destroyers.<sup>198</sup>

## 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.<sup>199</sup> A July 2, 2013, blog post states that

The U.S. Navy's multi-national exercises in the Pacific theater are growing in size and taking on new dimensions due to the U.S. military's overall strategic re-balance or "pivot" to the region, service officials explained.

Although many of the multi-national exercises currently underway have been growing in recent years, the U.S. military's strategic focus on the area is having a profound impact upon training activities there, Navy officials acknowledge.<sup>200</sup>

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<sup>191</sup> 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) .

<sup>192</sup> 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) .

<sup>193</sup> 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) .

<sup>194</sup> For more on the F-35 program, see CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by (name redacted) .

<sup>195</sup> 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) .

<sup>196</sup> For an article discussing the use of P-8 for countering Chinese submarines, see Jeremy Page, "As China Deploys Nuclear Submarines, U.S. P-8 Poseidon Jets Snoop on Them," *Wall Street Journal* (<http://online.wsj.com>), October 24, 2014.

<sup>197</sup> 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) .

<sup>198</sup> 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) .

<sup>199</sup> 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.

<sup>200</sup> Kris Osborn, "Navy Pivots Training to Match Pacific Transition," *DOD Buzz* ([www.dodbuzz.com](http://www.dodbuzz.com)), July 2, 2013.

## **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 nascent trilateral forms (e.g., U.S.-Japan-Australia, U.S.-Australia-India). A March 2, 2016, press report takes the idea further, stating:

The chief of the United States Pacific Command, Adm. Harry B. Harris Jr., on Wednesday proposed reviving an informal strategic coalition made up of the navies of Japan, Australia, India and the United States, an experiment that collapsed a decade ago because of diplomatic protests from China.

The proposal was the latest in a series of United States overtures to India, a country wary of forming strategic alliances, to become part of a network of naval powers that would balance China's maritime expansion.

The American ambassador to India, Richard R. Verma, expressed hope in a speech that "in the not-too-distant future," joint patrols by navy vessels from India and the United States "will become a common and welcome sight throughout Indo-Pacific waters."

And officials have said that the United States is close, after 10 years of demurral from the Indian side, to concluding a logistics agreement that would allow the two countries' militaries to easily use each other's resources for refueling and repairs....

Though he did not specifically mention China on Wednesday, Admiral Harris said powerful countries were seeking to "bully smaller nations through intimidation and coercion," and made the case that a broad naval collaboration was the best way to avert it.

"Exercising together will lead to operating together," he said, before meetings with his Indian counterpart. "By being ambitious, India, Japan, Australia and the United States and so many like-minded nations can aspire to operate anywhere in the high seas and the airspace above it."<sup>201</sup>

## **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 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 reductions in the size and capability of the U.S. Navy could encourage Chinese military overconfidence and demoralize U.S. allies and partners in the Pacific, and thereby destabilize or make it harder for the United States to defend its interests in the region.<sup>202</sup>

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<sup>201</sup> Ellen Barry, "U.S. Proposes Reviving Naval Coalition to Balance China's Expansion," *New York Times*, March 2, 2016.

<sup>202</sup> 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.

Current Navy plans, announced in December 2016, call for achieving and maintaining a fleet of 355 ships of various types and numbers. (The Navy's previous force-level goal, announced in March 2015, called for achieving and maintaining a fleet of 308 ships.)<sup>203</sup> Many observers are concerned that constraints on Navy budgets in coming years will result in a fleet with considerably fewer than 355 ships. The issue of whether the U.S. Navy in coming years will be large enough and capable enough to adequately counter improved Chinese maritime anti-access forces is part of a larger debate about whether the military pillar of the U.S. strategic rebalancing to the Asia-Pacific region is being 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. Aircraft and weapons with longer ranges could help Navy ships and aircraft achieve results while remaining outside the ranges of Chinese A2/AD systems that can pose a threat to their survivability.<sup>204</sup>

### 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. Some of 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).<sup>205</sup> In its FY2018 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

<sup>203</sup> For further discussion, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by (name redacted) .

<sup>204</sup> 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.

<sup>205</sup> 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 UCLASS," *Defense Daily*, March 7, 2014.



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 2018 will continue work that was begun under UCLASS and leverage previous work completed, focusing on the three segment areas: air, control system and connectivity, and carrier development.<sup>206</sup>

The Department of the Navy also states:

The Navy is committed to unmanned carrier aviation. Towards that end, we are embarking on efforts that will result in the development of an unmanned mission tanker to extend the range and reach of the Carrier Air Wing (CVW) with a secondary ISR mission. As MQ-25 will significantly extend CVW mission effectiveness range and address the future CVW-tanker gap, it will also preserve strike fighter fatigue life expectancy rates and help mitigate an expected strike fighter shortfalls (mid-2020s). As the first carrier-based 'Group 5' Unmanned Aircraft Systems (UAS), MQ-25 will pioneer the integration of manned-unmanned operations, mature complex sea-based C4I technologies, and pave the way for future multi-mission UASs to keep pace with emerging threats.<sup>207</sup>

## **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 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. At a May 24, 2017, hearing before the Seapower and Projection Forces subcommittee of the House Armed Services Committee, Navy officials summarized these efforts, stating that

The Department [of the Navy] 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 (first quarter of FY 2019 start). 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.

Second, the Department will field the Long Range Anti-Ship Missile (LRASM) as the air-launched Offensive Anti-Surface Warfare/Increment 1 (OASuW/Inc. 1) material solution to meet near to mid-term anti-surface warfare threats. LRASM is pioneering

<sup>206</sup> Department of the Navy, *Highlights of the Department of the Navy FY 2018 Budget*, 2017, p. 5-5.

<sup>207</sup> Statement of Allison F. Stiller, Principal Civilian Deputy Assistant Secretary of the Navy for Research, Development and Acquisition (ASN[RD&A]), performing the duties and functions of 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 K. Lescher, Deputy Chief of Naval Operations for Integration of Capabilities and Resources, before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Capabilities, May 24, 2017, pp. 13-14.

accelerated acquisition processes. We anticipate LRASM will meet all Joint Chiefs of Staff-approved warfighting requirements, deliver on-time, and cost within approximately one percent of its original program cost estimate.

Finally, the Department plans to develop follow-on next generation strike capabilities, including an air-launched OASuW/Increment 2 weapon to address long-term ASuW threats and a 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. To the maximum extent possible, the Department will leverage common components and component technologies to reduce cost, shorten development timelines, and promote interoperability.<sup>208</sup>

A December 14, 2015, press report states:

Worried about China's increasing naval might, the U.S. Navy is scrambling to buy new anti-ship missiles for the first time in decades and throwing out its old playbook for war strategy in the Pacific....

The emerging threat from China in particular has prompted American naval commanders to reevaluate their war-fighting strategy and to rush work on a new anti-ship missile for surface ships. The Pentagon plans to modify existing missiles that initially had been designed for other purposes, starting with the Tomahawk, which traditionally had been used against stationary targets on land....

The last time the American Navy sank another ship was in 1988, when the Perry-class frigate USS Simpson knocked out an Iranian gunboat four days after an Iranian mine struck an American vessel in the Persian Gulf. The Simpson was retired from the Navy's fleet this past September.

In the years since that showdown, the American fleet developed sophisticated missile defenses, drones, sonars, new fighter jets, and other hardware. But the Navy still has the same Harpoon anti-ship missiles that were first fielded in 1977.

Military officers believe Chinese warships could possibly shoot down or outmaneuver the aging Harpoon in a conflict, and that more sophisticated weapons are needed to provide the United States with a credible counterweight.

As a result, the Navy is pushing to arm its surface vessels and submarines with more effective anti-ship missiles with longer ranges — and better chances of evading high-tech defenses. Researchers tested a converted Tomahawk last January to see if it could hit a moving target at sea, and defense officials said the test was a success. The Navy plans to start deploying the weapon in “the fleet in the next few years,” said Lt. Robert Myers, a Navy spokesman.

The Navy is also studying the possibility of modifying a newer weapon, the Long Range Anti-Ship Missile, which is designed to be fired from an aircraft. Other options include a Norwegian manufactured naval strike missile that is already in production, or rejiggering a sophisticated air defense missile, the SM-6.<sup>209</sup>

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<sup>208</sup> Statement of Allison F. Stiller, Principal Civilian Deputy Assistant Secretary of the Navy for Research, Development and Acquisition (ASN(RD&A)), performing the duties and functions of 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 K. Lescher, Deputy Chief of Naval Operations for Integration of Capabilities and Resources, before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Capabilities, May 24, 2017, pp. 15-16.

<sup>209</sup> Dan De Luce, “The U.S. Navy Wants to Show China Who’s Boss,” *Foreign Policy*, December 14, 2015.

## **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 November 22, 2016, press report states:

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 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.<sup>210</sup>

## 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."<sup>211</sup>

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.<sup>212</sup> The Navy could acquire weapons and systems

<sup>210</sup> 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.

<sup>211</sup> David A. Fulghum, "USAF: Slash And Burn Defense Cuts Will Cost Missions, Capabilities," *Aerospace Daily & Defense Report*, September 30, 2011: 6.

<sup>212</sup> For a journal article discussing actions by the Navy during the period 1956-1972 to conceal the exact locations of Navy ships, see Robert G. Angevine, "Hiding in Plain Sight, The U.S. Navy and Dispersed Operations Under EMCON, 1956-1972," *Naval War College Review*, Spring 2011: 79-95. See also Jonathan F. Sullivan, *Defending the Fleet From China's Anti-Ship Ballistic Missile: Naval Deception's Roles in Sea-Based Missile Defense*, A Thesis submitted to the Faculty of the Graduate School of Arts and Sciences of Georgetown University in partial fulfillment of the requirements for the degree of Master of Arts in Security Studies, April 15, 2011, accessed August 10, 2011, at <http://gradworks.umi.com/1491548.pdf>; Jon Solomon, "Deception and the Backfire Bomber: Reexamining the Late Cold War Struggle Between Soviet Maritime Reconnaissance and U.S. Navy Countertargeting," *Information Dissemination* ([www.informationdissemination.net](http://www.informationdissemination.net)), October 27, 2014; John Solomon, "Deception and the Backfire (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 developing and procuring improved versions of the SM-3 BMD interceptor missile (including the planned Block IIA version of the SM-3), accelerating the acquisition of the Sea-Based Terminal (SBT) interceptor (the planned successor to the SM-2 Block IV terminal-phase BMD interceptor),<sup>213</sup> and accelerating development and deployment of the electromagnetic rail gun (EMRG), and solid state lasers (SSLs). 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.<sup>214</sup>

An October 4, 2016, press report states:

Several times in the past, [Chief of Naval Operations John] Richardson has stressed that long range weapons developments from adversarial nations like Russia and China aren't the end-all, be-all of naval conflicts.

Just because China's "carrier-killer" missile has a greater range than the planes aboard a US aircraft carrier doesn't mean the US would shy away from deploying a carrier within that range, Richardson has stated on different occasions.

Again, Richardson challenged the notion that a so-called A2/AD zone was "an impenetrable keep out zone that forces can only enter at extreme peril to their existence, let alone their mission."

Richardson took particular issue with the "denial" aspect of A2/AD, repeating his assertion that this denial is an "aspiration" not a "fait accompli." The maps so common in representing these threats often mark off the limits of different system's ranges with "red arcs that extend off coastlines," with the implication that military forces crossing these lines face "certain destruction."

But this is all speculation according to Richardson: "The reality is far more complex, it's actually really hard to achieve a hit. It requires the completion of a really complex chain of events.... these arcs represent danger for sure... but the threats they are based on are not insurmountable, and can be managed, will be managed."

"We can fight from within these defended areas, and we will... this is nothing new and has been done before," said Richardson.

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(...continued)

Bomber, Part II," *Information Dissemination* ([www.informationdissemination.net](http://www.informationdissemination.net)), October 28, 2014; John Solomon, "Deception and the Backfire Bomber, Part III," *Information Dissemination* ([www.informationdissemination.net](http://www.informationdissemination.net)), October 29, 2014; John Solomon, "Deception and the Backfire Bomber, Part IV," *Information Dissemination* ([www.informationdissemination.net](http://www.informationdissemination.net)), October 30, 2014.

<sup>213</sup> For more on the SM-3, including the Block IIA version, and the SBT, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by (name redacted) .

<sup>214</sup> 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 "7<sup>th</sup> 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.



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 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.”<sup>215</sup>

## 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—states 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.<sup>216</sup>

A February 28, 2012, press report stated:

“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.

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.<sup>217</sup>

<sup>215</sup> 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.

<sup>216</sup> Department of Defense, Director, Operational Test and Evaluation, *FY 2011 Annual Report*, December 2011, p. 294.

<sup>217</sup> 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.

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.<sup>218</sup>

A December 16, 2016, press report about a December 14, 2016, flight test of the Navy's Aegis ballistic missile defense system<sup>219</sup> states:

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.<sup>220</sup>

## 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 waters in the East China Sea, near Okinawa.<sup>221</sup> 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.<sup>222</sup> In December 2015, it was reported that during the encounter, the submarine conducted a simulated missile attack on the carrier.<sup>223</sup>

<sup>218</sup> Christopher J. Castelli, "DOD Testing Chief Drops Public Discussion Of ASBM Target Shortfall," *Inside the Navy*, January 21, 2013.

<sup>219</sup> 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) .

<sup>220</sup> Marc Selinger, "Missile Defense Agency Scores Second Intercept With Sea Based Terminal System," *Defense Daily*, December 16, 2016: 3-4.

<sup>221</sup> 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.

<sup>222</sup> 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*, (continued...)

Improving the Navy's ability to counter China's submarines could involve further increasing ASW training exercises,<sup>224</sup> 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).<sup>225</sup> 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:

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 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

(...continued)

November 4, 2015.

<sup>223</sup> Bill Gertz, "Chinese Submarine Practiced Missile Attack on USS Reagan," *Washington Free Beacon*, December 15, 2015.

<sup>224</sup> 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.

<sup>225</sup> 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.

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."<sup>226</sup>

## 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 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.<sup>227</sup>

<sup>226</sup> Dave Majumdar, "Chief of Naval Operations Richardson: US Navy is Focusing on Enemy Submarine Threat," *National Interest*, August 30, 2016.

<sup>227</sup> 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 Upgunning 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: (continued...)



The Navy's future fleet architecture is discussed further in another CRS report.<sup>228</sup>

## Legislative Activity for FY2018

### FY2018 Budget Request

The Trump Administration submitted its proposed FY2018 defense budget on May 23, 2017. 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)

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(...continued)

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.

<sup>228</sup> See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by (name redacted) .

## 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.<sup>229</sup>

### 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.<sup>230</sup> China's improving naval capabilities can be viewed as one reflection of that shift.

### U.S. Grand Strategy

Discussion of the above-mentioned shift in the international security environment 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 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.

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<sup>229</sup> 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) .

<sup>230</sup> For additional discussion, see CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by (name redacted) .

## U.S. Strategic Rebalancing to Asia-Pacific Region

A 2012 Department of Defense (DOD) strategic guidance document<sup>231</sup> and DOD's report on the 2014 Quadrennial Defense Review (QDR)<sup>232</sup> 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 potential 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.<sup>233</sup> More broadly, these observers view China's naval capabilities as a key element of an emerging broader Chinese military challenge to the long-standing status of the United States as the leading military power in the Western Pacific.

## 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.

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<sup>231</sup> Department of Defense, Sustaining U.S. Global Leadership: Priorities for 21<sup>st</sup> 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)

<sup>232</sup> 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)

<sup>233</sup> 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)

## 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)<sup>234</sup> claims in the East China (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.<sup>235</sup>

## 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.<sup>236</sup> 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.

## 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.<sup>237</sup>

<sup>234</sup> 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.

<sup>235</sup> 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); CRS Report R44072, *Chinese Land Reclamation in the South China Sea: Implications and Policy Options*, by (name redacted) et al.

<sup>236</sup> For a summary, see "U.S. Collective Defense Arrangements," accessed July 24, 2015, at <http://www.state.gov/s/l/treaty/collectivedefense/>.

<sup>237</sup> 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 21<sup>st</sup> 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-21<sup>st</sup> 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 4<sup>th</sup> 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 4<sup>th</sup> 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.<sup>238</sup>

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<sup>238</sup> [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.<sup>239</sup> 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

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(...continued)

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<sup>239</sup> 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 21<sup>st</sup> 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.<sup>240</sup>

## DOD Unclassified Summary Released June 2013

On June 3, 2013, DOD released an unclassified summary of the Air-Sea Battle concept.<sup>241</sup>

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<sup>240</sup> Source: transcript of hearing.

<sup>241</sup> 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](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](http://www.navy.mil/search/display.asp?story_id=63730).

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