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

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Summary

Concern has grown in Congress and elsewhere about China's military modernization. The topic is an increasing factor in discussions over future required U.S. Navy capabilities. The issue for Congress addressed in this report is: How should China's military modernization be factored into decisions about U.S. Navy programs?

Several elements of China's military modernization have potential implications for future required U.S. Navy capabilities. These include theater-range ballistic missiles (TBMs), land-attack cruise missiles (LACMs), anti-ship cruise missiles (ASCMs), surface-to-air missiles (SAMs), land-based aircraft, submarines, surface combatants, amphibious ships, naval mines, nuclear weapons, and possibly high-power microwave (HPM) devices. China's naval limitations or weaknesses include capabilities for operating in waters more distant from China, joint operations, C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance), long-range surveillance and targeting systems, anti-air warfare (AAW), antisubmarine warfare (ASW), mine countermeasures (MCM), and logistics.

Observers believe a near-term focus of China's military modernization is to field a force that can succeed in a short-duration conflict with Taiwan and act as an anti-access force to deter U.S. intervention or delay the arrival of U.S. forces, particularly naval and air forces, in such a conflict. Some analysts speculate that China may attain (or believe that it has attained) a capable maritime anti-access force, or elements of it, by about 2010. Other observers believe this will happen later. Potential broader or longer-term goals of China's naval modernization include asserting China's regional military leadership and protecting China's maritime territorial, economic, and energy interests.

China's naval modernization has potential implications for required U.S. Navy capabilities in terms of preparing for a conflict in the Taiwan Strait area, maintaining U.S. Navy presence and military influence in the Western Pacific, and countering Chinese ballistic missile submarines. Preparing for a conflict in the Taiwan Strait area could place a premium on the following: on-station or early-arriving Navy forces, capabilities for defeating China's maritime anti-access forces, and capabilities for operating in an environment that could be characterized by information warfare and possibly electromagnetic pulse (EMP) and the use of nuclear weapons.

Certain options are available for improving U.S. Navy capabilities by 2010; additional options, particularly in shipbuilding, can improve U.S. Navy capabilities in subsequent years. China's naval modernization raises potential issues for Congress concerning the role of China in Department of Defense (DOD) and Navy planning; the size of the Navy; the Pacific Fleet's share of the Navy; forward homeporting of Navy ships in the Western Pacific; the number of aircraft carriers, submarines, and ASW-capable platforms; Navy missile defense, air-warfare, AAW, ASW, and mine warfare programs; Navy computer network security; and EMP hardening of Navy systems. This report will be updated as events warrant.

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Introduction

Congressional Concern

Concern has grown in Congress and elsewhere since the 1990s about China's military modernization and its potential implications for required U.S. military capabilities. China's military modernization is an increasing element in discussions of future U.S. Navy requirements. Department of Defense (DOD) officials, Members of Congress, and defense industry representatives have all expressed concern. A May 2005 press report, for example, states that

> China is one of the central issues, along with terrorism and weapons of mass destruction, in the U.S. military's 2005 Quadrennial Defense Review, a congressionally directed study of military plans.... [W]hen the chief of naval operations, Adm. Vern Clark, held a classified briefing for congressional defense committees earlier this month about threats, his focus was "mainly" on China, about which he is "gravely concerned," recalled John W. Warner, the Virginia Republican who chairs the Senate Armed Services Committee....
>
> China has come up repeatedly in congressional debate over the size of the Navy. The 288-ship fleet of today is half the size it was three decades ago. "You never want to broadcast to the world that something's insufficient," Warner says, "but clearly China poses a challenge to the sizing of the U.S. Navy."[1]

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[1] John M. Donnelly, "China On Course To Be Pentagon's Next Worry," *CQ Weekly*, May 2, 2005, p. 1126. See also Anne Plummer, "Republican Senators Concerned About Timing Of Nay Force Reduction Plans," *CQ Today*, March 9, 2005. The American Shipbuilding Association, which represents the six U.S. shipyards that build the Navy's larger warships, states that a very ominous potential threat is building on the horizon. China has been officially modernizing its military for two-and-a-half decades. By 2010, China's submarine force will be nearly double the size of the U.S. submarine fleet. The entire Chinese naval fleet is projected to surpass the size of the U.S. fleet *by 2015*. In short, the Chinese military is specifically being configured to rival America's Sea Power. (Web page of the American Shipbuilding Association, located at [http://www.americanshipbuilding.com/]. Underlining as in the original.) See also Statement of Ms. Cynthia L. Brown, President, American Shipbuilding Association, Presented by Ms. Amy Praeger, Director of Legislative Affairs, Before the U.S.-China Economic and Security Review Commission On U.S.-China Trade Impacts on the Defense Industrial Base, June 23, 2005.

Issue for Congress

The issue for Congress addressed in this report is: How should China's military modernization be factored into decisions about U.S. Navy programs? Congress's decisions on this issue could significantly affect future U.S. Navy capabilities, U.S. Navy funding requirements, and the U.S. defense industrial base, including the shipbuilding industry.

Scope of Report

This report focuses on the implications that certain elements of China's military modernization may have for future required U.S. Navy capabilities. It does not discuss the following:

- other elements of China's military modernization that may be less relevant to future required U.S. Navy capabilities;

- the potential implications of China's military modernization for
  - — parts of DOD other than the Navy, such as the Air Force and the Missile Defense Agency,
  - — federal agencies other than DOD, such as the Department of State, and
  - — countries other than the United States, such as Taiwan, Russia, Japan, South Korea, the Philippines, the countries of Southeast Asia, Australia, India, and (through issues such as arms sales) countries such as Israel and U.S. allies in Europe; and

- China's foreign or economic policy, U.S. defense policy toward Taiwan, or the political likelihood of a military conflict involving China and the United States over Taiwan or some other issue.

Other CRS reports address some of these issues.[2]

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[2] See, for example, CRS Report RL31555, *China and Proliferation of Weapons of Mass Destruction and Missiles: Policy Issues*; CRS Report 98-485, *China: Possible Missile Technology Transfers Under U.S. Satellite Export Policy — Actions and Chronology*; CRS Report RL33001, *U.S.-China Counter-Terrorism Cooperation: Issues for U.S. Policy*; CRS Report RL32496, *U.S.-China Military Contacts: Issues for Congress*, all by Shirley Kan; CRS Report RL30427, *Missile Survey: Ballistic and Cruise Missiles of Selected Foreign Countries*, by Andrew Feickert; CRS Report RL32870, *European Union's Arms Embargo on China: Implications and Options for U.S. Policy*, by Kristin Archick, Richard F. Grimmett, and Shirley Kan; CRS Report RL30341, *China/Taiwan: Evolution of the 'One China' Policy — Key Statements from Washington, Beijing, and Taipei*, by Shirley A. Kan; CRS Report RL32804, *China-U.S. Relations: Current Issues and Implications for U.S. Policy*, by Kerry Dumbaugh; CRS Report RL30957, *Taiwan: Major U.S. Arms Sales Since 1990*, by Shirley A. Kan; CRS Issue Brief IB91121, *China-U.S. Trade Issues*, by Wayne W. Morrison; CRS Report RL32882, *The Rise of China and Its Effect on Taiwan, Japan, and South Korea: U.S. Policy Choices*, by Dick K. Nanto and Emma Chanlett-Avery; CRS Report RL32688, *China-Southeast Asia Relations: Trends, Issues, and Implications for the United States*, by Bruce Vaughn.

Terminology

For convenience, this report uses the term China's naval modernization, even though some of the military modernization efforts that could affect required U.S. Navy capabilities are occurring in other parts of China's military, such as the air force or the missile force.

China's military is formally called the People's Liberation Army, or PLA. Its navy is called the PLA Navy, or PLAN, 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 Second Artillery.

Sources

Sources of information for this report, all of which are unclassified, include the following:

- the 2005 edition of DOD's annual report to Congress on China's military power;[3]
- the 2004 edition of *Worldwide Maritime Challenges*, a publication of the U.S. Navy's Office of Naval Intelligence (ONI);[4]
- China's 2004 defense white paper;[5]
- the prepared statements and transcript of a July 27, 2005, hearing on China grand strategy and military modernization before the House Armed Services Committee;[6]
- the prepared statements for a September 15, 2005, hearing on China's military modernization and the cross-strait balance before the U.S.-China Economic and Security Review Commission, an advisory body created by the FY2001 defense authorization act (P.L. 106-398) and subsequent legislation,[7] and the prepared statements

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[3] U.S. Department of Defense, *Annual Report To Congress [on] The Military Power of the People's Republic of China, 2005*. Washington, Office of the Secretary of Defense, released July 2005. (Hereafter cited as *2005 DOD CMP*.)

[4] U.S. Department of the Navy, *Worldwide Maritime Challenges 2004*, Washington, prepared by the Office of Naval Intelligence. (Hereafter cited as *2004 ONI WMC*.)

[5] The white paper is entitled *China's National Defense in 2004*. (Hereafter cited as *2004 China White Paper*.) The English-language text of the white paper can be found on the Internet at [http://www.fas.org/nuke/guide/china/doctrine/natdef2004.html].

[6] Transcript hereafter cited as *7/27/05 HASC hearing*.

[7] Hereafter cited as *9/15/05 USCC hearing*. The Commission's website, which includes this and other past hearings, is at [http://www.uscc.gov].

and published transcript of a similar hearing before the commission on February 6, 2004;[8]

- a 2005 report on China's defense industry by the RAND Corporation;[9]
- a 2003 report on China's military power by an independent task force sponsored by the Council on Foreign Relations;[10]
- open-source military reference sources such as the Jane's Information Group; and
- news articles, including articles from the defense trade press.

Background

China's Naval Modernization

Maritime-Relevant Elements of China's Military Modernization[11]. This section summarizes elements of China's military modernization that may have potential implications for required U.S. Navy capabilities. See **Appendix A** for additional details and commentary on several of these modernization activities.

Theater-Range Ballistic Missiles (TBMs). One of the most prominent elements of China's military modernization has been the deployment of large numbers of theater-range ballistic missiles (TBMs)[12] capable of attacking targets in Taiwan or other regional locations, such as Japan.[13] Among these are CSS-6 and CSS-7 short-range ballistic missiles (SRBMs) deployed in locations across from

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[8] *Hearing On Military Modernization and Cross-Strait Balance, Hearing Before the U.S.-China Economic and Security Review Commission, February 6, 2004*. Washington, U.S. Govt. Print. Off., 2004. (Hereafter cited as *2/6/04 USCC hearing*.)

[9] Evan S. Medeiros et al, *A New Direction for China's Defense Industry*. Santa Monica, CA, RAND Corporation, 2005. 304 pp. (MG-334, RAND Project Air Force.) (Hereafter cited as *2005 RAND report*.)

[10] *Chinese Military Power, Report of an Independent Task Force Sponsored by the Council on Foreign Relations Maurice R. Greenberg Center for Geoeconomic Studies*. Washington, 2003. (Harold Brown, Chair, Joseph W. Prueher, Vice Chair, Adam Segal, Project Director) (Hereafter cited as *2003 CFR task force report*.)

[11] Unless otherwise indicated, shipbuilding program information in this section is taken from *Jane's Fighting Ships 2005-2006*. 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.

[12] Depending on their ranges, TBMs can be divided into short-, medium-, and intermediate-range ballistic missiles (SRBMs, MRBMs, and IRBMs, respectively).

[13] ONI states that "China is developing TBM systems with sufficient range to threaten U.S. forces throughout the region, to include [those] in Japan." (*2004 ONI WMC*, p. 20.)

Taiwan. DOD states that China as of 2005 has deployed 650 to 730 CSS-6 and CSS-7 TBMs, and that this total is increasing at a rate of about 100 missiles per year.[14]

Although ballistic missiles in the past have traditionally been used to attack fixed targets on land, observers believe China may now be developing TBMs equipped with maneuverable reentry vehicles (MaRVs). Observers have expressed strong concern about this potential development, because such missiles, in combination with a broad-area maritime surveillance and targeting system,[15] would permit China to attack moving U.S. Navy ships at sea. The U.S. Navy has not previously faced a threat from highly accurate ballistic missiles capable of hitting moving ships at sea. Due to their ability to change course, MaRVs would be more difficult to intercept than non-maneuvering ballistic missile reentry vehicles. According to one press report, "navy officials project [that such missiles] could be capable of targeting US warships from sometime around 2015."[16]

Land-Attack Cruise Missiles (LACMs). China is developing land-attack cruise missiles (LACMs) that can be fired from land bases, land-based aircraft, or Navy platforms such as submarines to attack targets, including air and naval bases, in Taiwan or other regional locations, such as Japan or Guam. The U.S. Defense

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[14] *2005 DOD CMP*, p. 4. See also China's Military Power: An Assessment From Open Sources, Testimony of Richard D. Fisher, Jr., International Assessment and Strategy Center, Before the House Armed Services Committee, July 27, 2005, p. 9. (Hereafter cited as *Fisher 7/27/05 testimony*.)

[15] DOD stated in 2002: "China's procurement of new space systems, airborne early warning aircraft and long-range UAV, and over-the-horizon radar will enhance its ability to detect, monitor, and target naval activity in the Western Pacific Ocean. China may have as many as three over-the-horizon (OTH) sky-wave radar systems, which China aspires to use against aircraft carriers." (Department of Defense, *Annual Report On The Military Power of the People's Republic Of China, 2002*. Washington, 2002, released July 2002. pp. 4-5. See also pp. 28-29.)

A December 2005 press article states:

> In 2004 China bought Russian Podsolnikh-E high-frequency (HF) surface-wave radars for coastal surveillance. These radars use the ionosphere and the conducting surface of the sea as reflectors to form the boundaries of a waveguide. They reach beyond the usual radar horizon.... What is special about HF radar is that the wavelength is so long (typically 10 to 150 meters) that it is not greatly affected by the shape of the object it encounters. Stealth shaping would have little or no effect on detection. Maximum range against surface targets, set by the nature of HF propagation, is generally given as 180 nautical miles, and aginst air targets as 250 nautical miles.
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> (Norman Friedman, "China Purchases Russian Radars," *U.S. Naval Institute Proceedings*, December 2005: 90.)

[16] Yihong Chang and Andrew Koch, "Is China Building A Carrier?" *Jane's Defence Weekly*, August 17, 2005.

Intelligence Agency (DIA) states: "We judge that by 2015, [China] will have hundreds of highly accurate air- and ground-launched LACMs."[17]

Anti-Ship Cruise Missiles (ASCMs). China is modernizing its extensive inventory of anti-ship cruise missiles (ASCMs), which can be launched from land-based strike fighters and bombers, surface combatants, submarines and possibly shore-based launchers. Among the most capable of the new ASCMs being acquired by the PLA Navy is the Russian-made SS-N-27 Sizzler, a highly dangerous ASCM that is to be carried by eight new Kilo-class submarines that China has purchased from Russia (see section below on submarines).

Surface-To-Air Missiles (SAMs). China is deploying modern surface-to-air missile (SAM) systems across from Taiwan, including long-range and high-altitude systems that have an advertised range sufficient to cover the entire Taiwan Strait, which is roughly 100 nautical miles (185 kilometers) wide. Advanced SAMs may have some effectiveness against stealthy aircraft. Longer- and shorter- range SAM systems deployed along China's coast opposite Taiwan would in combination give China a multilayer defense against enemy aircraft seeking to operate over the Strait or approach that portion of China's coast.[18]

Land-Based Aircraft. China is introducing increasing numbers of modern and capable (so-called fourth-generation) fighters and strike fighters into the PLA Air Force and PLA Naval Air Force. These include Russian-made Su-27s and Su-30s and indigenously produced FB-7s, F-10s, and F-11s. At least some of the strike fighters will be armed with modern ASCMs. China is also upgrading the ASCMs carried by its land-based maritime bombers. The effectiveness of China's combat aircraft could be enhanced by new support aircraft, including tankers and airborne warning and control system (AWACS) aircraft.

Submarines. China's submarine modernization effort has attracted substantial attention and concern.[19] The effort currently involves the simultaneous acquisition of at least five classes of submarines, making it, in terms of number of designs involved, one of the more ambitious submarine-acquisition efforts on record by any country. China is taking delivery on eight Russian-made Kilo-class non-nuclear-powered attack submarines (SSs) that are in addition to four Kilos that China

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[17] Current and Projected National Security Threats to the United States, Vice Admiral Lowell E. Jacoby, U.S. Navy, Director, Defense Intelligence Agency, Statement for the Record [before the] Senate Select Committee on Intelligence, 16 February 2005, p. 13. See also Current and Projected National Security Threats to the United States, Vice Admiral Lowell E. Jacoby, U.S. Navy, Director, Defense Intelligence Agency, Statement For the Record [before the] Senate Armed Services Committee, 17 March 2005, p. 13.

[18] See the map entitled "SAM Area Coverage Circles," in *2004 ONI WMC*, p. 29.

[19] For a detailed discussion of China's submarine modernization program and a strong expression of concern regarding the implications of this effort for Taiwan and the United States, see the statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, pp. 129-156. Goldstein's written statement was also published as a journal article; see Lyle Goldstein and William Murray, "Undersea Dragons, China's Maturing Submarine Force," *International Security*, spring 2004, pp. 161-196.

purchased from Russia in the 1990s,[20] and is building four other classes of submarines, including the following:

- a new nuclear-powered ballistic missile submarine (SSBN) design called the Type 094;
- a new nuclear powered attack submarine (SSN) design called the Shang class or Type 093;
- a new SS design called the Yuan class or Type 041; and
- another (and also fairly new) SS design called the Song class or Type 039/039G.

These five classes of submarines are expected to be much more modern and capable than China's aging older-generation submarines.

As shown in **Table 1**, China commissioned one to three new submarines per year between 1995 and 2003. Observers project that 11 new submarines (including six Kilos) will be commissioned in 2005, and five or more new submarines (including two Kilos) will be commissioned in 2006. The projected total of 11 new submarines in 2004 appears to be a spike produced in part by the projected delivery that year of the six Russian-made Kilos.[21]

PLA Navy submarines are armed with one or more of the following: ASCMs, wire-guided and wake-homing torpedoes, and mines.[22] Although ASCMs are often highlighted as sources of concern, wake-homing torpedoes can also be very difficult for surface ships to counter. In addition to some combination of ASCMs, torpedoes, and mines, Type 094 SSBNs will carry a new type of submarine-launched ballistic missile (SLBM), and Shang-class SSNs may carry LACMs.

China's submarine modernization effort is producing a substantially more modern and capable submarine force. As shown in **Table 1**, observers expect China to have a total of 28 Shang, Kilo, Yuan, and Song class submarines in commission by the end of 2006.

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[20] A previous CRS report discussed these four Kilo-class boats at length. See CRS Report RL30700, *China's Foreign Conventional Arms Acquisitions: Background and Analysis*, by Shirley Kan (Coordinator), Christopher Bolkcom, and Ronald O'Rourke.

[21] ONI states that all eight Kilo-class boats are scheduled for delivery by 2005. (*2004 ONI WMC*, p. 12.) Some other sources project that the final boat or boats will be delivered by 2007.

[22] There are also reports that the Kilos might also be armed with the Shkval, a Russian-made, supercavitating, high-speed torpedo, and that China might be building its own supercavitating torpedoes. (Statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, p. 139.) A supercavitating torpedo surrounds itself with an envelope of gas bubbles, which dramatically reduces its resistance as it moves through the water, thereby permitting very high underwater speeds. The Shkval has a reported speed of 200 knots or more.

Table 1. PLA Navy Submarine Commissionings

Actual (1995-2004) and Projected (2005-2010)

	Type 094 SSBN	Shang (Type 093) SSN	Kilo SS (Russian-made)	Yuan (Type 041) SS	Song (Type 039) SS	Ming (Type 035) SS[a]	Total
1995			2			1	**3**
1996						1	**1**
1997						2	**2**
1998			1			2	**3**
1999			1		1		**2**
2000						1	**1**
2001					2	1	**3**
2002						1	**1**
2003					2		**2**
2004					3		**3**
2005		2[b]	6		3		**11**
2006		n/a	2	2	1		**≥5**
2007		n/a		n/a	n/a		**n/a**
2008	1	n/a		n/a	n/a		**n/a**
2009		n/a		n/a	n/a		**n/a**
2010	1[c]	n/a		n/a	n/a		**n/a**

Source: *Jane's Fighting Ships 2005-2006*, and previous editions.

a. Figures for Ming-class boats are when the boats were launched (i.e., put into the water for final construction). Actual commissioning dates for these boats may have been later.
b. Construction of a third ship may have started.
c. Additional units are expected, perhaps at two-year intervals.

n/a = data not available.

Although China's aging Ming- and Romeo-class submarines are based on old technology and are much less capable than the PLA Navy'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 more modern PLA Navy submarines.[23]

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[23] One observer states that

> older and less sophisticated submarines will likely be employed to screen the higher-value assets. Chinese sources openly describe using certain submarines as "bait." Employing this tactic, it is conceivable that United States submarines could reveal their own presence to lurking Kilos by executing attacks against nuisance Mings and Romeos. No wonder China continues to operate the vessels, which are widely derided as obsolete by Western observers. The threat from these older submarines cannot be dismissed out of hand. Informal United

ONI states that "Chinese diesel submarine force levels are stabilizing as quality replaces quantity," and has published a graph accompanying this statement suggesting that the figure may stabilize at a level between 25 and 50.[24]

Another observer states that by 2010,

> the PLA Navy could take delivery of over 20 new domestic SONG A and YUAN-class conventional submarines, 12 Russian KILO-877/636/636M conventional submarines, and five or more new indigenous Type 093 nuclear attack submarines (SSNs) — the third Type 093 is now under construction. In addition, the PLAN could retain up to 20 older Type 035 MING-class conventional [attack submarines] and about 4 older Type 091 HAN-class SSNs. This raises the prospect by 2010 of a Chinese fleet of over 50 modern-to-moderate [sic] attack submarines capable of engaging Taiwan, U.S. and Japanese naval forces.[25]

A separate observer states:

> China has been investing heavily in submarines which it sees as the poisoned arrow (Shashou jian) to the Achilles Heel of American naval might....
>
> By my count, China will have a net gain of 35 submarines over the next 15 years, with no production slow-down in sight. It is reasonable to assume that at current production levels, China will likely out-produce our shipyards and its submarines could out-number our submarines in the next 15 years. By 2020, the Chinese submarine fleet could boast nearly 50 modern attack boats....
>
> [The 2005 DOD report on China's military power] has catalogued a list of China's foreign weapons and military systems acquisitions, but in my mind none is as worrisome as the expansion of the PLA Navy's submarine fleet. China has identified America's strategic center as its maritime predominance, and its sub fleet is clearly designed to overcome U.S. supremacy at sea.[26]

One more observer states that:

> the PLA Navy now has the capability to make the antisubmarine warfare (ASW) mission very difficult for U.S. forces. With a total of more than 50 operational submarines, and with a substantial number of them new and quiet, China, quite simply, can put to sea more submarines than the U.S. Navy can locate and

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States Navy testimony suggests that the PLAN can operate the older classes of diesel submarines with surprising tactical efficiency. (Statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, p. 153)

[24] *2004 ONI WMC*, p. 11. The range of 25 to 50 is based on visual inspection of the graph.

[25] *Fisher 7/27/05 testimony*, p. 11. On page 4, Fisher similarly states "It can be estimated that by 2010 the PLA Navy could have 50 to 60 nuclear and new conventional attack submarines...."

[26] China's Military Power, Testimony of John J. Tkacik, Jr., Senior Research Fellow in Asian Studies, The Heritage Foundation, Before the Committee on Armed Services, United States House of Representatives, Washington, D.C., July 27, 2005. p. 8. (Hereafter cited as *Tkacik 7/27/05 testimony*.)

> counter. Its older Ming and Romeo submarines are not only still lethal if ignored but also serve to disperse and dilute the efforts of the ASW forces. In other words, some, or even many, of the already large and diverse, but still rapidly growing, fleet of very capable Shang SSNs, and Kilo, Song, and Yuan SSs can reasonably expect to remain undetected as they seek to interdict the U.S. carrier strike groups. If the "shooting has started," eventually U.S. ASW forces could take a big toll against the Chinese submarine force, but the delay in sanitizing the area before the entry of carrier strike groups is what the Chinese are counting on as adequate delay to present the world with the aforementioned *fait accompli* with respect to Taiwan.[27]

Yet one more observer states:

> Evidence suggests that China is seeking to become a first-class submarine power. While the PLAN modernization shows impressive breadth with major new purchases of naval aircraft and surface combatants, submarines appear to be the centerpiece of China's strategic reorientation toward the sea. The May 2002 contract for eight additional Kilos, the likely continuation of the Song program, and nuclear force modernization, taken together with the evident new priority on training, technological research and doctrinal development all suggest that Beijing recognizes the value of submarines as a potent, asymmetric answer to United States maritime superiority. The recent ascendance of a submariner, Adm. Zhang Dingfa, to the position of commanding officer of the PLAN underlines these tendencies. Further investments in diesel submarines, particularly when enhanced by air independent propulsion, will afford Beijing increasing near-term leverage in the East Asian littoral, while methodical nuclear modernization signifies a long-term commitment to global power projection. As one Chinese strategist recently observed, "The scale [of recent purchases] indicates that in the coming years, China will build an offshore defense system with submarines as the key point."[28]

Aircraft Carriers. ONI states that "China's interest in aircraft carriers has not led it to build or purchase one, except as museums. Near-term focus on contingencies in the vicinity of Taiwan has minimized the importance of aircraft carriers in China's acquisition plan, but research into the ships and associated aircraft likely continues."[29] Another observer states:

> Since the early 1980s... analysts have debated the question of whether China would build aircraft carriers. The events of 2005 have now given us the answer. Yes, China will build aircraft carriers. The debate now shifts to new questions: what type, what size, how many, and how soon?...

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[27] [Statement of] Rear Admiral (U.S. Navy, Retired) Eric A. McVadon, Director of Asia-Pacific Studies, Institute for Foreign Policy Analysis, Consultant on East Asia Security Affairs, Before the U.S.-China Economic and Security Review Commission, [regarding] Recent Trends in China's Military Modernization, 15 September 2005, p. 5. (Hereafter cited as *McVadon 9/15/05 testimony*.) The *fait accompli* mentioned at the end of the quote is discussed later in this report.

[28] Statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, pp. 155-156.

[29] *2004 ONI WMC*, p. 10.

> Public information began to leak out of China in mid-2005 due to patriotic Chinese enthusiasts who posted internet photos of the Varyag[30] undergoing major work at about that time. The Dalian shipyards [in China] are located near a highway overpass that allows for clear photos of the ship. Prior to 2005 many photos showed that China had undertaken minimal work to clean up the ship's exterior, but at least during the day, there was no evidence of substantial activity around the ship....
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> But in late May 2005 the Varyag moved into a drydock for the first time, and it emerged in early August with a fresh coat of paint — this time in standard PLA Navy grey. While a seemingly minor development, the adoption of this color clearly indicates the Varyag is to be adopted by the PLAN for some yet-to-be-determined missions. Subsequent photos seen in December 2005 appear to show activity on the deck to apply new coatings consistent with aircraft operations....
>
> The most decisive information regarding China's carrier intentions came during the Summer of 2005, when new data emerged regarding the gathering PLA Naval Air Force carrier air wing. The important new data emerged at the August Moscow Aerospace Salon. It became clear that China was going to Russia for actual carrier combat aircraft, or the technologies to modify a Chinese fighter for carrier operations....
>
> The Russian sources interviewed at the Moscow Airshow, plus subsequent Russian press reports, offer fairly strong confirmation of China's plans to acquire a large CTOL [conventional takeoff and landing] aircraft carrier are now proceeding....
>
> After a long debate it can be concluded that China is now actively preparing for the day when it acquires large CTOL aircraft carriers. There is no solid information regarding the ultimate purpose for the Varyag, though speculation ranges from use for pilot training, to performing the role of moving target in order for the PLA to perfect its emerging anti-carrier doctrine and operations. Furthermore, it is not yet possible to conclude that China is going to build a Russian-style carrier, thought that would appear to be the fastest solution. Nor it is possible yet to conclude how China will employ its carriers.[31]

Surface Combatants. China since the early 1990s has purchased four Sovremenny-class destroyers from Russia and deployed eight new classes of indigenously built destroyers and frigates that demonstrate a significant modernization of PLA Navy surface combatant technology. The introduction of eight new destroyer and frigate designs over a period of about 15 years is an

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[30] The Varyag is a partially Soviet aircraft carrier that was being built by a shipyard in Ukraine, which was then a part of the Soviet Union. Construction on the ship was stopped in 1993, two years after the dissolution of the Soviet Union, when the ship reportedly was between 70% and 80% complete. The uncompleted ship was reportedly sold to Chinese interests and towed to China, arriving at the Dalian shipyards in March 2002.

[31] Richard Fisher, Jr., "2005: A Turning Point for China's Aircraft Carrier Ambitions," published by the International Assessment and Strategy Center, and available on the Internet at: [http://www.strategycenter.net/research/pubID.87/pub_detail.asp#]. See also Norman Friedman, "Varyag Redux?" *U.S. Naval Institute Proceedings*, December 2005: 91.

undertaking with few parallels by any country in recent decades. China has also deployed a new kind of fast attack craft that uses a stealthy catamaran hull design.

Sovremenny-Class Destroyers. China in 2002 ordered two Sovremenny-class destroyers from Russia. The ships, which reportedly are to be delivered in 2005 and 2006, are in addition to two Sovremenny-class destroyers that China ordered from Russia in 1996 and which entered service in 1991 and 2001. Sovremenny-class destroyers are equipped with the SS-N-22 Sunburn ASCM, another dangerous ASCM.[32] The SS-N-22s on the two Sovremenny-class ships ordered in 2002 are expected to be an improved version with a longer range. China reportedly has an option for two more Sovremenny-class ships, which, if exercised, would make for an eventual total of six ships.[33]

Five New Indigenously Built Destroyer Classes. China since the early 1990s has built five new classes of destroyers. Compared to China's 16 older Luda (Type 051) class destroyers, which entered service between 1971 and 1991, these 5 new destroyer classes are substantially more modern in terms of their hull designs, propulsion systems, sensors, weapons, and electronics. A key area of improvement in the new destroyer designs is their anti-air warfare (AAW) technology,[34] which has been a significant PLA Navy shortcoming. Like the older Luda-class destroyers, these new destroyer classes are armed with ASCMs.

As shown in **Table 2**, China to date has commissioned only 1 or 2 ships in each of these five classes, suggesting that a key purpose of at least some of these classes may have been to serve as stepping stones in a plan to modernize the PLA Navy's surface combatant technology incrementally before committing to larger-scale series production.[35] If one or more of these designs are put into larger-scale production, it would accelerate the modernization of China's surface combatant force.

The **Luhu-class ships** reportedly were ordered in 1985 but had their construction delayed by a decision to give priority to the construction of six frigates that were ordered by Thailand. The **Luhai-class ship** is believed to have served as the basis for the Luyang-class designs. Compared to the Luhai, the **Luyang I-class ships** appear stealthier and are believed to feature an AAW system with a longer-ranged SAM.

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[32] A previous CRS report discussed the PLA Navy's first two Sovremenny-class destroyers and their SS-N-22 ASCMs at length. See CRS Report RL30700, op cit.

[33] ONI puts the potential number of additional ships at two or three. (*2004 ONI WMC*, p. 10.)

[34] AAW is a term most frequently found in discussions of naval systems. Discussions of systems in other military services tend to use the term air defense.

[35] One set of observers states that "China was forced to cancel its production of the Luhu class of destroyers because the U.S.-made gas turbine engines were no longer available after the United States imposed export restrictions on military-related goods following the Tiananmen Square incident in 1989. China's newest operational destroyers use Ukrainian, not Chinese, engines." (*2005 RAND report*, p. 140.)

Table 2. New PLA Navy Destroyer Classes

Class name	Type	Number built	Hull number(s)	In service (actual or projected)
Luhu	052	2	112, 113	1994, 1996
Luhai	051B	1	167	1999
Luyang I	052B	2	168, 169	2004
Luyang II	052C	2	170, 171	2004, 2005
n/a	051C	2	115, n/a	2006, 2007

Source: *Jane's Fighting Ships 2005-2006.*

n/a = data not available.

The **Luyang II-class ships** appear to feature an even more capable AAW system that includes a SAM called the HQ-9 that has an even longer range, a vertical launch system (VLS), and a phased-array radar that is outwardly somewhat similar to the SPY-1 radar used in the U.S.-made Aegis combat system. Indeed, the Luyang II-class design bears some resemblance to U.S. and Japanese Aegis destroyers, though they are probably not as modern or capable in some respects as the U.S. and Japanese ships.[36] The two **Type 051C-class ships** feature a VLS and a long-range SAM, but in other respects might be less advanced in their design than the Luyang II-class destroyers. They may have been designed earlier and had their construction delayed. Even so, they are still relatively modern ships.

Three New Indigenously Built Frigate Classes. China since the early 1990s has built three new classes of frigates that are more modern than China's 31 older Jianghu (Type 053) class frigates, which entered service between the mid-1970s and 1989. The three new frigate classes, like the new destroyer classes, feature improved AAW capabilities. Unlike the new destroyer designs, the new frigate designs have been put into larger-scale series production. **Table 3** summarizes the three new classes.

Table 3. New PLA Navy Frigate Classes

Class name	Type	Number built or building	Hull number(s)	In service (actual or projected)
Jiangwei I	053G H2G	4	539-542	1991-1994
Jiangwei II	053H3	10	between 521 and 567	1998-2005
Jiangkai	054	3	525, 526, n/a	2004-2006

Source: *Jane's Fighting Ships 2005-2006.* n/a = data not available.

[36] For a detailed article about the Luyang II class, see James C. Bussert, "China Debuts Aegis Destroyers," *Signal*, July 2005, pp. 59-62. See also *Fisher 7/27/05 testimony*, p. 12.

Construction of **Jiangwei I-class ships** appears to have ceased but observers believe that construction of the **Jiangwei II- and Jiangkai-class ships** is continuing and additional units beyond those shown in **Table 3** are expected. The Jiangkai-class ships feature a stealthy design that somewhat resembles France's La Fayette-class frigate, which first entered service in 1996.[37]

New Class Of Fast Attack Craft. In addition to its 190 older fast attack craft (including 37 armed with ASCMs), China in 2004 introduced a new type of ASCM-armed fast attack craft built on a stealthy, wave-piercing, catamaran hull that is one of the more advanced hull designs used by any navy in the world today. Observers believe the hull design is based on a design developed by a firm in Australia, a country which is a world leader in high-speed catamaran designs. At least three of these new fast attack craft are now in service, and additional units are expected.[38]

Amphibious Ships. China is currently building three new classes of amphibious ships and landing craft, all of which began construction in 2003. Each type is being built at three or four shipyards. Between these three classes, China built a total of 19 amphibious ships and 8 amphibious landing craft in 2003 and 2004.

Mine Countermeasures (MCM) Ships. China is building a new class of mine countermeasures (MCM) ship, the first unit of which was expected to enter service in 2005.

Naval Mines. Regarding naval mines, ONI states:

> China is developing and exporting numerous advanced mines of all types. One example is the wireless remote controlled EM57, a mine that offers many tactical options. For example, the mine can be turned off and on remotely to prolong its life, or it can be activated and deactivated to allow safe passage for friendly vessels.[39]

DOD stated in 2003 that the PLA's mines

> include bottom and moored influence mines, mobile mines, remotely controlled mines, command-detonated mines, and propelled-warhead mines. Use of

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[37] France sold a modified version of the La Fayette-class design to Taiwan; the six ships that Taiwan built to the design entered service in 1996-1998. See also *Fisher 7/27/05 testimony*, pp. 12-13. One observer views the Jiangwei II-class ships as roughly comparable to France's Georges Leygues-class destroyer design, which entered service in 1979, Italy's Maestrale-class frigate design, which entered service in 1982, and the UK's Type 21 frigates, which entered service in starting in 1975 and were transferred to Pakistan in 1993-1994. (Massimo Annati, "China's PLA Navy, The Revolution," *Naval Forces*, No. 6, 2004, pp. 66-67.)

[38] Reference books do not show a name for this new class of attack craft, so the craft are identified by their hull numbers. The first three ships carry numbers 2208-2210. See also *Fisher 7/27/05 testimony*, p. 13; "PRC Appears Ready To Field New Trimaran Fast Missile Warship," *Defense & Foreign Affairs Daily*, October 5, 2004; Yihong Chang, "First Sight Of Chinese Catamaran," *Jane's Defense Weekly*, May 26, 2004.

[39] *2004 ONI WMC*, p. 19.

> propelled-warhead mines in deep waters has the potential to deny enemy naval formations large operational areas.[40]

DOD stated in 2002 that China "likely has enough mine warfare assets to lay a good defensive and a modest offensive minefield using a wide variety of launch platforms."[41]

Another observer stated in a presentation that China has

> a large inventory of mines. And we see a tremendous interest in some of the most modern deadly mines going. These deep water rising mines [on the projection screen] can be purchased from Russia. They have tremendous ability to mine deeper waters where we would prefer to operate. So what we would consider to have been a haven [for U.S. Navy ships] may no longer be a haven.[42]

Information Warfare/Information Operations (IW/IO). China open-source writings demonstrate an interest in information warfare (IW), also called information operations (IO), as an increasingly important element of warfare, particularly against a sophisticated opposing force such as the U.S. military. Concern about potential PLA IW/IO capabilities has been heightened by recent press reports about attacks on U.S. computer systems that in some cases appear to have originated in China.[43] One observer has stated that "China even now is planting viruses in U.S.

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[40] U.S. Department of Defense, *Annual Report On The Military Power of the People's Republic of China, 2003*. Washington, Office of the Secretary of Defense, released July 2003. p. 27.

[41] Department of Defense, *Annual Report On The Military Power of the People's Republic Of China, 2002*. Washington, 2002, released July 2002. p. 23. In 2000, DOD stated:

> The PLAN's mine stockpiles include vintage Russian moored-contact and bottom influence mines, as well as an assortment of domestically built mines. China currently produces the EM11 bottom-influence mine; the EM31 moored mine; the EM32 moored influence mine; the EM52 rocket-propelled rising mine; and, the EM-53 ship-laid bottom influence mine which is remotely controlled by a shore station. China is believed to have available acoustically activated remote control technology for its EM53. This technology probably could be used with other Chinese ship-laid mines including the EM52. Application of this technology could allow entire mines to be laid in advance of hostilities in a dormant position and activated or deactivated when required. China reportedly has completed development of a mobile mine and may be producing improved variants of Russian bottom mines and moored-influence mines. Over the next decade, China likely will attempt to acquire advanced propelled-warhead mines, as well as submarine-launched mobile bottom mines. (Department of Defense, *Annual Report On The Military Power of the People's Republic Of China, 2000*. Washington, 2000. See the subsection on subsurface warfare.)

[42] Statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, p. 133. See also p. 152.

[43] See *2005 DOD CMP*, p. 36; *2003 CFR task force report*, pp. 55-56; Peter Brookes, "The Art Of (Cyber) War, *New York Post*, August 29, 2005; Bradley Graham, "Hackers Attack Via Chinese websites," *Washington Post*, August 25, 2005: 1; Frank Tiboni, "The New Trojan War," *Federal Computer Week*, August 22, 2005: 60.

computer systems that they will activate" in the event of a military conflict with the United States.[44]

Nuclear Weapons. Although China is not necessarily modernizing its nuclear weapon technology, it is worth noting that China, as a longstanding nuclear weapon state, could put nuclear warheads on weapons such as TBMs, LACMs, ASCMs, torpedoes, and naval mines. China could use nuclear-armed versions of these weapons (except the LACMs) to attack U.S. Navy ships at sea. China might do so in the belief that it could subsequently confuse the issue in the public arena of whose nuclear warhead had detonated,[45] or that the United States in any event would not escalate the conflict by retaliating with a nuclear attack on a land target in China. During the Cold War, analysts debated whether the use of a Soviet nuclear weapon against U.S. Navy ships during a conflict would lead to a U.S. nuclear response.

China could also use a nuclear-armed ballistic missile to detonate a nuclear warhead in the atmosphere to create a high-altitude electromagnetic pulse (EMP) intended to temporarily or permanently disable the electronic circuits of U.S. or other civilian and military electronic systems. Some observers have expressed concern in recent years over the potential vulnerability of U.S. military systems to EMP effects.[46]

High-Power Microwave (HPM) Weapons. Some observers are concerned that China might develop or already possess high-power microwave (HPM) weapons, also called radio frequency weapons (RFWs) or E-bombs, which are non-nuclear devices that can be used to generate damaging EMP effects over relatively short distances to disable the electronic circuits of nearby enemy civilian and military systems.[47] In theory, an HPM weapon could be placed on a TBM or ASCM and fired at a U.S. Navy ship. Although the effective EMP radius of such devices might be on

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[44] Eric McVadon, as quoted in Dave Ahearn, "U.S. Can't Use Trade Imbalance To Avert China Invasion Of Taiwan," *Defense Today*, August 2, 2005, pp. 1-2.

[45] Following the April 1, 2001, collision in international airspace off China's coast of a U.S. Navy EP-3 electronic surveillance aircraft and a PLA F-8 fighter, which many observers believed was caused by reckless flying by the pilot of the F-8, China attempted to convince others that the collision was caused by poor flying by the pilot of the slower-flying and less maneuverable U.S. EP-3. For more on this event, see CRS Report RL30946, *China-U.S. Aircraft Collision Incident of April 2001: Assessments and Policy Implications*, by Shirley A. Kan, coordinator.

[46] See CRS Report RL32544, *High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments*, by Clay Wilson; (Hereafter cited as CRS Report RL32544.) and John S. Foster, Jr., et al., *Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack, Volume 1: Executive Report 2004*. Washington, 2004, 53 pp. (Hereafter cited as *2004 EMP commission report*.) See also the transcripts and written statements of hearings on EMP held before the House Armed Services Committee on July 22, 2004, and before the Military Research and Development Subcommittee of the House Armed Services Committee on October 7, 1999, and July 16, 1997. (In 1997, the full committee was called the House National Security Committee.)

[47] For more on HPM weapons, see CRS Report RL32544.

the order of only a few hundred yards,[48] such devices could be used to attack individual U.S. Navy ships without the political or escalatory risks of a high-altitude nuclear detonation.[49]

Military Doctrine, Education, Training, Exercises, and Logistics. Military capability is a product not simply of having weapons, but of having a doctrine for how to use them, well-educated and well-trained personnel, realistic exercises, and logistic support. In past years, the PLA was considered weak in some or all of these areas, and PLA military capability consequently was considered not as great as its inventory of weapons alone might suggest. The 2004 China defense white paper states an intention to improve in these areas,[50] and observers believe the PLA is acting on these intentions. DOD says that "China has stated its intentions and allocated resources to pursue force-wide professionalization, improve training, conduct more robust, realistic joint exercises, and accelerate acquisition of modern weapons."[51] The PLA in recent years has developed a doctrine for joint operations

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[48] One source states that "a 2,000-pound microwave munition will have a minimum radius [of effect] of approximately 200 meters," or roughly 650 feet. ("High-power microwave (HPM)/E-Bomb," available on the Internet at [http://www.globalsecurity.org/military/systems/munitions/hpm.htm].)

A second source says HPM weapons might have effective radii "on the order of hundreds of meters, subject to weapon performance and target set electrical hardness." (Section 4.1 of Carlo Kopp, "The Electromagnetic Bomb — a Weapon of Electrical Mass Destruction," available on the Internet at [http://www.globalsecurity.org/military/library/report/1996/apjemp.htm].

A third source states that "a small RF device might have a range measured in feet, while a relatively large RF device might produce upset or damage in electronics systems at a range measured in hundreds of feet, and interference at a range of hundreds of miles." (Statement of William R. Graham, Ph.D., before the Military Research and Development Subcommittee of the House Armed Services Committee, October 7, 1999.)

[49] One source states that:

> An electromagnetic warhead detonated within lethal radius of a surface combatant will render its air defence system inoperable, as well as damaging other electronic equipment such as electronic countermeasures, electronic support measures and communications. This leaves the vessel undefended until these systems can be restored, which may or may not be possible on the high seas. Therefore launching an electromagnetic glidebomb on to a surface combatant, and then reducing it with laser or television guided weapons is an alternate strategy for dealing with such targets. (Section 10.4 of Carlo Kopp, "The Electromagnetic Bomb — a Weapon of Electrical Mass Destruction," op cit.)

[50] See the sections entitled "Reducing the PLA by 200,000," "Implementing the Strategic Project for Talented People," "Intensifying Joint Training," and "Deepening Logistical Reforms," in Chapter II on national defense policy.

[51] *2005 DOD CMP*, p. 26.

involving multiple military services,[52] improved its military education and training and conducted more realistic exercises,[53] and reformed its logistics system.[54] Improvements in these areas might be considered as important as the weapon-modernization activities discussed above. Some of these improvements may require several years to fully implement.

China's Naval Limitations and Weaknesses. In spite of the concerns raised by the modernization effort described above, observers believe PLA military (including naval) forces continue to have limitations or weaknesses in the following areas, among others:

- sustained operations in waters and air space that are more distant from China;
- joint operations;
- C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) systems, including, for example, airborne warning and control system (AWACS) capabilities;
- long-range surveillance and targeting systems for detecting and tracking ships at sea — a capability needed to take full advantage of longer-ranged anti-ship weapons;
- anti-air warfare (AAW) capability for defending surface ships against air attack;
- antisubmarine warfare (ASW) capability for defending surface ships against submarine attack;
- mine countermeasures (MCM) capability; and
- logistics.

The paragraphs below elaborate on these items.

Weaknesses And Limitations In General. Regarding PLA Navy limitations and weaknesses in general, DIA states:

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[52] See, for example, *2005 DOD CMP*, pp. 5-6; the statement of David M. Finkelstein as printed in *2/6/04 USCC hearing*, p. 90-93; and *2003 CFR task force report*, pp. 38-39.

[53] See, for example, [Statement of] Dennis J. Blasko, Independent Consultant, September 15, 2005, Hearing on "Net Assessment of Cross-Strait Military Capabilities" Before the U.S.-China Economic and Security Review Commission; the statement by Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, pp. 131-132, 143-145; and *2003 CFR task force report*, pp. 39-41, 45-46, 49.

[54] Regarding reformed logistics, see *2005 DOD CMP*, p. 34, and the statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, p. 145.

> China continues to develop or import modern weapons.... The PLA must overcome significant integration challenges to turn these new, advanced and disparate weapon systems into improved capabilities. Beijing also faces technical and operational difficulties in numerous areas.[55]

Another set of observers states:

> The PLAN is limited by a lack of integration in its command, control, and communication systems; targeting; air defense; and antisubmarine warfare capabilities. PLAN ships are vulnerable to attack by aircraft, torpedoes, and antiship missiles. The navies of the ASEAN nations could, if able to operate together, exclude the PLAN from the South China Sea....
>
> New capabilities are limited by the lack of some critical supporting systems. The PLAN is deficient in antisubmarine warfare capabilities. PLAN ships are also vulnerable to air attack by both aircraft and antiship missiles.[56]

A separate set of observers states that weaknesses in China's shipbuilding industry

> are more problematic for naval projects [than for commercial shipbuilding projects]. Although China is designing and building increasingly sophisticated warships, Chinese naval shipbuilders still need to import key components or modules, such as propulsion systems, navigation and sensor suites, and major weapon systems, to outfit these vessels. Such a reliance on imported subsystems creates systems-integration challenges, as well as security concerns stemming from dependence on foreign suppliers. China appears to be improving its ability to absorb imported equipment and technologies, but it will take time before these and other problems are overcome.[57]

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[55] Current and Projected National Security Threats to the United States, Vice Admiral Lowell E. Jacoby, U.S. Navy, Director, Defense Intelligence Agency, Statement for the Record [before the] Senate Select Committee on Intelligence, 16 February 2005, p. 16. See also Current and Projected National Security Threats to the United States, Vice Admiral Lowell E. Jacoby, U.S. Navy, Director, Defense Intelligence Agency, Statement For the Record [before the] Senate Armed Services Committee, 17 March 2005, p. 16.

[56] *2003 CFR task force report*, pp. 28 and 47.

[57] *2005 RAND report*, pp. 110-111. On page 153, the report similarly states that

> China's SBI [shipbuilding industry] exhibits a number of limitations and weaknesses that will constrain naval modernization. Although the design and construction of vessels have improved, the SBI has experienced numerous problems producing quality subsystems for both merchant and naval vessels. Chinese shipbuilders have had to rely heavily on foreign imports for the power plants, navigation and sensor suites, and key weapon systems for its newest naval platforms. For example, Chinese marine-engine factories have had difficulties producing gas turbine engines powerful enough for large destroyers and related combatants. The last two classes of Chinese destroyers have relied on imported gas turbine engines, for example. This high degree of reliance on foreign goods creates major challenges for systems integration and, given the inconsistent availability of certain weapon systems, complicates serial production of some platforms.

These observers also state that

> the capabilities of most of China's current naval SAM and SSM systems and much of its naval electronics are limited and not equivalent to U.S. capabilities or those of other Asian militaries. The limited range and accuracy of Chinese SSMs and SAMs create serious problems for air-defense and antisubmarine warfare. Many of these systems also do not operate with over-the-horizon targeting, further degrading their already-limited capabilities.
>
> Furthermore, few — if any — advances were made in the development and production of naval propulsion or navigation equipment in the 1980s or 1990s. This lack continues to be a major weakness in China's domestic naval production efforts, and one that the PLAN's heavy reliance on foreign subsystems for its second-generation vessels testifies to.[58]

Regarding the submarine force, one observer states that

> by no means should the PLAN submarine force be considered ten feet tall. China's submarine force has some significant weaknesses: a reliance on diesel submarines that have to approach the surface to snorkel; especially in the wake of the Ming 361 accident,[59] it is evident that crew training and professionalism remain a fundamental problem; finally, there is little evidence of a robust, remote cueing capability, and probable weakness in the sphere of command and control.[60]

Sustained Operations in Distant Waters. Regarding sustained operations in more distant waters, DOD states: "We assess that China's ability to project conventional military power beyond its periphery remains limited," and that

> China does not appear to have broadened its concept of operations for anti-access and sea denial to encompass sea control in waters beyond Taiwan and its immediate periphery. If China were to shift to a broader "sea control" strategy, the primary indicators would include: development of an aircraft carrier, development of robust anti-submarine warfare capabilities, development of a true area anti-air warfare capability, acquisition of large numbers of nuclear attack

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[58] *2005 RAND report*, p. 139-140. On pages 153-154, the report similarly states that

> Chinese combatants lack long-range air-defense systems, modern anti — submarine warfare (ASW) weapons, and advanced electronic warfare capabilities needed to outfit its new ships. China's other defense sectors have been slow to produce modern versions of these crucial technologies beyond copies or modifications of Soviet or Western systems. For example, Chinese firms have experienced several delays in the indigenous production of a medium and long-range SAM system for naval area defense, which has complicated the completion of some naval projects.... [T]his situation is changing as China's defense-industrial complex modernizes. But, some past weaknesses persist and, over the medium term, they will continue to constrain China's ability to project and sustain naval power for extended periods in the coming decade.

[59] This is a reference to an April 2003 fatal accident aboard a Ming-class boat with hull number 361. See **Appendix A** for additional details concerning this accident.

[60] Statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, p. 156.

submarines, development of effective maritime C4ISR, and increased open water training....

With its present force structure, according to the Intelligence Community, Chinese surface combatants would have difficulty projecting power into the Strait of Malacca, especially if it were conducting simultaneous blockade or invasion operations elsewhere. Similarly, although the PLA Navy occasionally patrols as far as the Spratly Islands, its limited organic air defense capability leaves surface ships vulnerable to attack from hostile air and naval forces. The PLA Navy Air Force and PLA Air Force currently lack the operational range to support PLA Navy operations. In recent years, however, the PLA Navy's South Sea Fleet, which has operational responsibility over the South China Sea, has been assigned more capable surface combatants and submarines, including two destroyers (one LUDA IV class and one LUHAI class) that provide it with its first short-range area air-defense capability, the HHQ-7C surface-to-air missile systems.[61]

Joint Operations. Regarding joint operations, DOD states:

Although the PLA has devoted considerable effort to develop joint capabilities, it faces a persistent lack of inter-service cooperation and a lack of actual experience in joint operations.... The lack of experience in joint operations is a subset of the overall lack of operational experience in the Chinese force.[62]

Similarly, Regarding training for amphibious and other expeditionary operations, DOD states:

Combined training for all these units is seldom conducted in a major amphibious assault exercise. Units tend to train for their missions in garrisons, local areas and regional training facilities. China's ability to integrate individual unit actions — or simulate integration — to assess accurately operational capability, is not known.[63]

Another observer states:

There is no question that China has achieved a remarkable leap in modernization of the forces needed for these missions and that it is urgently continuing on that path. There *is* question about how China is now proceeding to exercise these new assets so as to make them truly operational in a combat environment. There is *considerable question* about China's capability to coordinate all these forces in two major simultaneous operations: (1) to bring Taiwan to its knees and (2) cause the U.S. to be tardy, indecisive, or ineffective in responding.[64]

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[61] *2005 DOD CMP*, executive summary and pp. 33-34.

[62] *2005 DOD CMP*, p. 17.

[63] Ibid., p. 31.

[64] *McVadon 9/15/05 testimony*, p. 6. Italics as in the original.

Anti-Air Warfare (AAW). Regarding AAW, one observer states that China's decision to "shed its strictly coastal defense force structure in favor of acquiring larger and more modern fighting vessels capable of blue-water operations" has

> exposed a significant vulnerability — the PLAN's inability to provide a sophisticated, layered air defense for these new forces. Fleet air defense is the Achilles' heel of the 21st-century Chinese Navy....
>
> As the PLAN's ships increased in size, capability and endurance, and with operational deployments taking them well beyond the navy's traditional mainland-based air defenses, a challenge not faced previously became apparent: having to defend these units from air attack in the event of hostilities. Response to this concern has been slow and inadequate at best, and serious consideration to providing the surface navy with the kind of air defense systems one normally associates with modern naval fleets has only begun. Not until the late 1990s was an effort made to outfit PLAN destroyers and frigates with an antiair "point defense" system, giving them some measure of self-defense.... The PLAN surface fleet, however, still lacks "modern air surveillance systems and data links required for area air defense missions. The combination of short-range weapons and lack of modern surveillance systems limits the PLAN to self-defense and point-defense [AAW] only. As a result, except in unusual circumstances, no PLAN ship is capable of conducting air defense of another ship."[65]
>
> In a similar vein, today's PLAN naval aviation forces alone cannot provide fighter coverage for the entire Chinese coast or the fleet, so interceptor duties have ben distributed by region between naval aviation units and the PLA Air Force. This increases the number of assets available for the task, but questions remain about joint patrolling, separate chains of command, and air force over-water proficiency. When faced with training scenarios that incorporated factors likely found in a modern air combat environment, such as electronic countermeasures or even inclement weather, neither service was up to the task. In light of these facts, the potential effectiveness of the cooperation between the two services is doubtful.
>
> Significant gaps exist in the present PLAN fleet air defense posture. Given the forces available today, China cannot adequately defend its fleet from air attack in the modern air threat environment.[66]

Antisubmarine Warfare (ASW). Regarding ASW, one observer states:

> The most serious deficiency of the PLAN is certainly in the area of Anti-Submarine Warfare. Good submarines, like the "Kilo" class and (possibly) the forthcoming Type-093, will play an important ASW role, but the lack of maritime patrol aircraft and of surface ships equipped with advanced acoustic

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[65] The passage at this point is quoting from the 2003 edition of DOD's annual report on China's military power (*2003 DOD CMP*, p. 25).

[66] Dominic DeScisciolo, "Red Aegis," *U.S. Naval Institute Proceedings*, July 2004, pp. 56-58.

> sensors make the Chinese vessels vulnerable for [sic] any of the foreign high-capability submarines operating in the area.[67]

Mine Countermeasures (MCM). Regarding MCM, one observer writes that for the PLA Navy a

> serious operational deficiency involves the mine countermeasures vessels (MCMV). Though China has an intense shipping [sic] along its coasts, the PLAN has virtually no mine-sweeping or mine-hunting capabilities. This was due, perhaps, to the consideration that the U.S. Navy is usually more concerned to keep the sea lanes open, instead of laying mines, but nevertheless the lack of MCM is simply stunning. Any hostile organisation (including, but not limited to, state-sponsored terrorists and insurgents) could play havoc with the Chinese shipping simply by laying a few mines here and there.[68]

Logistics. Regarding logistics, DOD states:

> Since 2000, China has improved the structure, material coordination, and efficiency of its joint logistics system. However, the command system is still not compatible with the support system, and organization and planning is incompatible with supply management. The first experimental joint logistics unit was created only in July 2004.[69]

Regarding logistic support of China's new destroyers, one observer states:

> The ships' new sensors, missiles and combat systems are mainly of Russian and Western origin. However, China now is faced with the challenge of operating and maintaining these advanced systems to create a credible threat to foreign navies in Far Eastern waters....
>
> Every piece of equipment [on China's Sovremenny-class destroyers] from hull, mechanical and electrical (HM&E) technologies to guns, sonar, communications, electronic countermeasures (ECM) and missiles are totally new to the PLAN.... [For these ships,] China is dependent on Russian advisers for training, operations and maintenance. These ships largely remain in the Russian support cocoon in Dinghai rather than at a fleet base....
>
> Isolation from other ships and crews hurts fleet integration and coordinated operations.... It is no coincidence that the Sovremnyi and Kilo submarine home bases are in an enclave of Russian support in an isolated area near the Eastern Fleet headquarters at Ningbo.
>
> It is unlikely that Russian advisers would be onboard during actual combat operations against Taiwan and U.S. Navy air, surface and subsurface threats. PLAN officers and crew are not expected to be able to handle operations when under fire, sustaining hits and suffering system degradation or loss. This could

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[67] Massimo Annati, "China's PLA Navy, The Revolution," *Naval Forces*, No. 6, 2004, p. 75.

[68] Ibid., p. 73.

[69] *2005 DOD CMP*, pp. 34-35.

include problems in night or rough weather environment as well. Because all of the combat systems, except for three noted, are modern Russian equipments, China has minimal capability even to repair peacetime losses in port....

A comparison [of the AAW system on the Luyang II class destroyers] to [the] U.S. Navy Aegis [combat system] is inevitable, but Aegis was on [the U.S. Navy test ship] Norton Sound for nine years of development testing prior to the first installation on the USS Ticonderoga (CG-47) 20 years ago. Developing the software for signal processing and tracking a hundred air, surface and submarine targets will take even longer for China. Integration to various indigenous ship guns and missiles and other sensors, as well as other ships' data management and weapons, will take longer. These Chinese "Aegis" ships may be limited to 1940s era radar tasks of detecting and tracking air and surface targets for their own ship weapons. Further in the future will be an 8,000-ton DDG that is predicted to be a true area-control warship with additional Aegis capabilities. It is now in early construction stages in the new Dalian shipyard.

What kind of record is provided by prior Chinese built warships with imported Russian and Western technology? These include sensors, fire control, weapons and communications as well as HM&E. The Chinese new-construction DDGs are a mix of local designed and manufactured systems, foreign imports with production rights, illegally copied import equipment and illegal examples with no local production capability at all. The latter two represent serious training and maintenance problems. Unfortunately for the PLAN, some of them are in the highest mission-critical areas. For example, the DDGs being built have a rapid-fire Gatling gun close-in weapon system that looks like the Dutch Goalkeeper system. Signaal and the Dutch government deny exporting the equipment or production rights to China. This key weapon responsible for downing incoming cruise missiles is probably lacking documentation and training because it must be illegally obtained.[70]

Goals or Significance of China's Naval Modernization.

PLA Navy As A Modernization Priority. The PLA Navy is one of three stated priorities within China's overall military modernization effort. China's 2004 defense white paper says three times that the effort will emphasize the navy, air force, and the ballistic missile force.[71] Consistent with this stated emphasis, the heads of

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[70] James C. Bussert, "China Builds Destroyers Around Imported Technology," *Signal*, August 2004, p. 67.

[71] The white paper states:

The PLA will promote coordinated development of firepower, mobility and information capability, enhance the development of its operational strength with priority given to the Navy, Air Force and Second Artillery Force, and strengthen its comprehensive deterrence and warfighting capabilities....

The Army is streamlined by reducing the ordinary troops that are technologically backward while the Navy, Air Force and Second Artillery Force are strengthened....

While continuing to attach importance to the building of the Army, the PLA

the PLA Navy, Air Force, and missile force were added to the Central Military Commission in September 2004, and Navy and Air Force officers were appointed Deputy Chiefs of the General Staff.[72]

Near-Term Focus: Taiwan Situation. DOD and other observers believe that the primary near-term focus of China's military modernization is to develop military options for addressing the situation with Taiwan.[73] DOD lists China's potential military options regarding Taiwan as follows:

- **persuasion and coercion**, which "combines the credible threat to use military force with the economic and cultural tools that China has at its disposal";
- **limited force options** that could employ "information operations, special operations forces on Taiwan, and SRBM or air strikes at key military or political sites, to try to break the will of Taiwan's leadership and population";
- **an air and missile campaign**, in which "Surprise SRBM attacks and precision air strikes could support a campaign designed to degrade Taiwan defenses, decapitate its military and political leadership, and break its will to fight rapidly before the United States and other nations could intervene";
- **a blockade**, which "Beijing could threaten or deploy... either as a 'non-war' pressure tactic in the pre-hostility phase or as a transition to active conflict";[74] and
- **amphibious invasion**, which "would be a complex and difficult operation relying upon timing and pre-conditions set by many subordinate campaigns."[75]

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gives priority to the building of the Navy, Air Force and Second Artillery Force to seek balanced development of the combat force structure, in order to strengthen the capabilities for winning both command of the sea and command of the air, and conducting strategic counter-strikes. (*2004 China White Paper*, op cit, Chapter II national defense policy.)

[72] See, for example, *2005 DOD CMP*, p. 1.

[73] Ibid., executive summary.

[74] Analysts disagree regarding China's potential for mounting an effective blockade, particularly with its submarine force. For an analysis that casts a skeptical eye on the potential, see Michael A. Glosny, "Strangulation from the Sea? A PRC Submarine Blockade of Taiwan," *International Security*, spring 2004, pp. 125-160. For an analysis that expresses more concern about this potential, see the statement of Lyle J. Goldstein as printed in *2/6/04 USCC hearing*, pp. 132-133, 147-151.

[75] *2005 DOD CMP*, pp. 39-42. See also *2003 CFR task force report*, pp. 2, 3, and 53.

Anti-Access Force For Short-Duration Conflict. More specifically, observers believe that China's military modernization is aimed at fielding a force that can succeed in a short-duration conflict with Taiwan that finishes before the United States is able to intervene, so that China can present the United States and the rest of the world with a *fait accompli*. DOD states that China is "emphasizing preparations to fight and win short-duration, high-intensity conflicts along China's periphery."[76]

Regarding the potential time line for a short-duration conflict with Taiwan, one observer states:

> The U.S. (particularly the U.S. Pacific Command/PACOM) seems to want Taiwan to focus on [acquiring] systems and defensive operational capabilities that would lengthen the amount of time Taiwan could deny the PRC from gaining air superiority, sea control, and physical occupation of Taiwan's leadership core (namely Taipei). The idea is to permit sufficient time to bring U.S. forces to bear. The amount of time needed is understood to be at least 5 days, presumably after credible warning that hostilities either are imminent or are already underway.[77]

Consistent with the goal of a short-duration conflict and a *fait accompli*, observers believe, China wants its modernized military to be capable of acting as a so-called anti-access force — a force that can deter U.S. intervention, or failing that, delay the arrival or reduce the effectiveness of U.S. intervention forces, particularly U.S. Navy forces. DOD states that, in addition to preventing Taiwan independence or trying to compel Taiwan to negotiate a settlement on Beijing's terms, "A second set of objectives includes building counters to third-party, including potential U.S., intervention in cross-Strait crises."[78]

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[76] *2005 DOD CMP*, executive summary. See also Eric A. McVadon, "Alarm Bells Ring as China Builds up its Armoury on a Massive Sale," *Jane's Defence Weekly*, March 16, 2005, p. 23; Edward Cody, "China Builds A Smaller, Stronger Military," *Washington Post*, April 12, 2005, p. 1; Bryan Bender, "China Bolsters Its Forces, US Says," *Boston Globe*, April 10, 2005, p. 1; Jim Yardley and Thom Shanker, "Chinese Navy Buildup Gives Pentagon New Worries," *New York Times*, April 8, 2005.

[77] Testimony of Fu S. Mei, Director, Taiwan Security Analysis Center (TAISAC), Before the U.S.-China Economic and Security Review Commission [regarding] "Taiwan Straits Issues and Chinese Military-Defense Budget," September 15, 2005, p. 3.

[78] *2005 DOD CMP*, executive summary. DOD also states that "China is developing capabilities to achieve local sea denial, including naval mines, submarines, cruise missiles, and special operations forces." (Ibid., p. 33.) Another observer states that

> This mission, in essence, is to be able quickly to overwhelm Taiwan's military, cow the Taiwan government, and deter, delay, or complicate effective and timely U.S. intervention....
>
> The concept is ... to be able very rapidly, in a matter of days, to cause Taiwan to capitulate, with such capitulation abetted by the failure of the U.S. to respond promptly and effectively. As has been said often, Beijing's concept is to be able to present to Washington and the world a *fait accompli* concerning Taiwan....
>
> Beijing has ... developed a concept to use force, if it feels it must, to defeat

China's emerging maritime anti-access force can be viewed as broadly analogous to the sea-denial force that the Soviet Union developed during the Cold War to deny U.S. use of the sea or counter U.S. forces participating in a NATO-Warsaw Pact conflict. One potential difference between the Soviet sea-denial force and China's emerging maritime anti-access force is that China's force could include MaRV-equipped TBMs capable of hitting moving ships at sea.

Some analysts speculate that China may attain (or believe that is has attained) a capable maritime anti-access capability, or important elements of it, by about 2010.[79] Other observers believe China will attain (or believe that it has attained) such a capability some time after 2010. DOD states that "The U.S. Intelligence Community estimates that China will require until the end of this decade or later for its military modernization program to produce a modern force, capable of defeating a moderate-size adversary."[80] The term "moderate-size adversary" would appear to apply to a country other than the United States. The issue of when China might attain (or believe that it has attained) a capable anti-access capability is significant because it can influence the kinds of options that are available to U.S. policymakers for addressing the situation.

Broader or Longer-Term Regional Goals. In addition to the near-term focus on developing military options for addressing the situation with Taiwan, DOD

> Taiwan, deter or delay U.S. intervention, and at least cause Japan to think twice before introducing overt military assistance in a developing crisis....
>
> There is, in my opinion, no question that this is Beijing's concept for overwhelming Taiwan and deterring or confronting U.S. forces. (*McVadon 9/15/05 testimony*, pp. 1, 2, 2-3, 6.)

[79] One observer, for example, states:

> Because the Chinese submarine fleet will operate in nearby waters and in the mid-Pacific, China need not wait until 2020 to challenge the U.S. at sea. It will likely have a home-field advantage in any East Asian conflict contingency as early as 2010, while the U.S. fleet will still have operational demands in the Middle East, and in tracking Russian ballistic missile submarines elsewhere. (*Tkacik 7/27/05 testimony*, p. 8.)

See also *Fisher 7/27/05 testimony*, which cites the year 2010 on pages 3, 4, 7, 9 (twice), 11, and 16 in discussing China's military modernization and the resulting impact on the regional military balance, and Fisher's statement as printed in *2/6/04 USCC hearing*, p. 85, which states, "It is possible that before the end of the decade the PLA will have the capability to coordinate mass missile attacks on U.S. Naval Forces by submarines and Su-30s," and p. 88, which prints his table summarizing potential PLA anti-carrier forces by 2010.

[80] *2005 DOD CMP*, p. 26. Another observer states: "QDR [Quadrennial Defense Review] planners have recently moved forward (to 2012) their estimate of when key warfighting capabilities might be needed to fight China, and have postulated conflict scenarios lasting as long as seven years." (Loren B. Thompson, "Pentagon Fighter Study Raises Questions," August 22, 2005. Lexington Institute Issue Brief.) *2003 CFR task force report* discusses the difficulty of assessing the pace at which China's military modernization is occurring and presents a series of indicators on pages 11-15 (and again on pages 64-68) that can be monitored to help gauge the pace and direction of China's military modernization.

and some (but not necessarily all) other observers believe that broader or longer-term goals of China's military modernization, including naval modernization, include one or more of the following:

- **asserting China's regional military leadership**, displacing U.S. regional military influence, prevailing in regional rivalries, and encouraging eventual U.S. military withdrawal form the region;

- **defending China's claims in maritime territorial disputes**, some of which have implications for oil, gas, or mineral exploration rights;[81] and

- **protecting China's sea lines of communication**, which China relies upon increasingly for oil and other imports.[82]

Some PLA Navy units have recently been deployed outside China's home waters. In November 2004, for example, a Han-class SSN was detected in Japanese territorial waters near Okinawa.[83] DIA states that, as part of the same deployment, this submarine traveled "far into the western Pacific Ocean...."[84] Press reports state that the submarine operated in the vicinity of Guam before moving toward Okinawa.[85] As another example, on September 9, 2005,

> China deployed a fleet of five warships... near a gas field in the East China Sea, a potentially resource-rich area that is disputed by China and Japan. The ships, including a guided-missile destroyer, were spotted by a Japanese military patrol plane near the Chunxiao gas field, according to the [Japan] Maritime

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[81] For more on this topic, see CRS Report RL31183, *China's Maritime Territorial Claims: Implications for U.S. Interests*, Kerry Dumbaugh, coordinator.

[82] See, for example, *2005 DOD CMP*, pp. 12-13 and 33; *Fisher 7/27/05 testimony*, p. 4; *McVadon 9/15/05 testimony*, p. 1; *2003 CFR task force report*, pp. 24-25, 31-32, 62-63; Edward Cody, "China Builds A Smaller, Stronger Military," April 12, 2005, p. 1; David Lague, "China's Growing Undersea Fleet Presents Challenge To Its Neighbors," *Wall Street Journal*, November 29, 2004.

[83] Mark Magnier, "China Regrets Sub Incident, Japan Says," *Los Angeles Times*, November 17, 2004; Martin Fackler, "Japanese Pursuit Of Chinese Sub Raises Tensions," *Wall Street Journal*, November 15, 2004: 20; Kenji Hall, "Japan: Unidentified sub is Chinese," *NavyTimes.com (Associated Press)*, November 12, 2004.

[84] Current and Projected National Security Threats to the United States, Vice Admiral Lowell E. Jacoby, U.S. Navy, Director, Defense Intelligence Agency, Statement for the Record [before the] Senate Select Committee on Intelligence, 16 February 2005, p. 16-17. See also Current and Projected National Security Threats to the United States, Vice Admiral Lowell E. Jacoby, U.S. Navy, Director, Defense Intelligence Agency, Statement For the Record [before the] Senate Armed Services Committee, 17 March 2005, p. 17.

[85] Timothy Hu, "Ready, steady, go...," *Jane's Defence Weekly*, April 13, 2005: 27; "China Sub Tracked By U.S. Off Guam Before Japan Intrusion," *Japan Times*, November 17, 2004.

Self-Defense Forces. It is believed to be the first time that Chinese warships have been seen in that area.[86]

As a third example,

> China said on Sept. 29 [of 2005 that] it has sent warships to the disputed East China Sea, a day ahead of talks with Japan over competing territorial claims in the gas-rich waters.
>
> "I can now confirm that in the East China Sea, a Chinese reserve vessel squadron has been established," foreign ministry spokesman Qin Gang told a regular briefing....
>
> No details were given on the size of the squadron or the area it will patrol. The establishment of the squadron follows China's creation of two naval groups in the Bohai Sea and Yellow Sea off the northern China coast, the agency said.[87]

Regarding base access and support facilities to support more distant PLA Navy operations, one press report states:

> China is building up military forces and setting up bases along sea lanes from the Middle East to project its power overseas and protect its oil shipments, according to a previously undisclosed internal report prepared for Defense Secretary Donald H. Rumsfeld.
>
> "China is building strategic relationships along the sea lanes from the Middle East to the South China Sea in ways that suggest defensive and offensive positioning to protect China's energy interests, but also to serve broad security objectives," said the report sponsored by the director, Net Assessment, who heads Mr. Rumsfeld's office on future-oriented strategies.
>
> The Washington Times obtained a copy of the report, titled "Energy Futures in Asia," which was produced by defense contractor Booz Allen Hamilton.
>
> The internal report stated that China is adopting a "string of pearls" strategy of bases and diplomatic ties stretching from the Middle East to southern China....[88]

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[86] Norimitsu Onishi and Howard W. French, "Japan's Rivalry With China Is Stirring A Crowded Sea," *New York Times*, September 11, 2005. See also "Japan Upset Over Chinese Warships Near Disputed Area," *DefenseNews.com*, October 3, 2005.

[87] "China Sends Warships to East China Sea," *DefenseNews.com*, September 29, 2005.

[88] Bill Gertz, "China Builds Up Strategic Sea Lanes," *Washington Times*, January 18, 2005, p. 1. The report stated that China is:

- operating an eavesdropping post and building a naval base at Gwadar, Pakistan, near the Persian Gulf;
- building a container port facility at Chittagong, Bangladesh, and seeking "much more extensive naval and commercial access" in Bangladesh;
- building naval bases in Burma, which is near the Strait of Malacca;
- operating electronic intelligence-gathering facilities on islands in the Bay

Potential Implications for Required U.S. Navy Capabilities

Potential implications of China's naval modernization for required U.S. Navy capabilities can be organized into three groups:

- capabilities for a crisis or conflict in the Taiwan Strait area;
- capabilities for maintaining U.S. Navy presence and military influence in the Western Pacific; and
- capabilities for detecting, tracking, and if necessary countering PLA Navy SSBNs equipped with long-range SLBMs.

Each of these is discussed below.

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of Bengal and near the Strait of Malacca;
- building a railway line from China through Cambodia to the sea;
- improving its ability to project air and sea power into the South China Sea from mainland China and Hainan Island;
- considering funding a $20-billion canal that would cross the Kra Isthmus of Thailand, which would allow ships to bypass the Strait of Malacca and permit China to establish port facilities there.

According to the article,

> The Pentagon report said China, by militarily controlling oil shipping sea lanes, could threaten ships, "thereby creating a climate of uncertainty about the safety of all ships on the high seas."
>
> The report noted that the vast amount of oil shipments through the sea lanes, along with growing piracy and maritime terrorism, prompted China, as well as India, to build up naval power at "chokepoints" along the sea routes from the Persian Gulf to the South China Sea.
>
> "China ... is looking not only to build a blue-water navy to control the sea lanes, but also to develop undersea mines and missile capabilities to deter the potential disruption of its energy supplies from potential threats, including the U.S. Navy, especially in the case of a conflict with Taiwan," the report said....
>
> "The Iraq war, in particular, revived concerns over the impact of a disturbance in Middle Eastern supplies or a U.S. naval blockade," the report said, noting that Chinese military leaders want an ocean-going navy and "undersea retaliatory capability to protect the sea lanes."
>
> China believes the U.S. military will disrupt China's energy imports in any conflict over Taiwan, and sees the United States as an unpredictable country that violates others' sovereignty and wants to "encircle" China, the report said.

See also Edward Cody, "China Builds A Smaller, Stronger Military," *Washington Post*, April 12, 2005, p. 1.

Capabilities for Taiwan Strait Crisis or Conflict. U.S. military operations in a potential crisis or conflict in the Taiwan Strait area would likely feature a strong reliance on U.S. Navy forces and land-based U.S. Air Force aircraft.[89] If air bases in Japan and South Korea are, for political reasons, not available to the United States for use in the operation, or if air bases in Japan, South Korea, or Guam are rendered less useful by PLA attacks using TBMs, LACMs, or special operations forces, then the reliance on U.S. Navy forces could become greater.

For the U.S. Navy, a crisis or conflict in the Taiwan Strait could place a premium on the following:

- on-station or early-arriving forces;
- forces with a capability to defeat PLA anti-access weapons and platforms;
- forces with an ability to operate in an environment that could be characterized by IW/IO and possibly EMP or the use of nuclear weapons directly against Navy ships; and
- forces that can be ready to conduct operations by about 2010, or by some later date.

On-Station and Early-Arriving Forces. In the scenario of a short-duration conflict, on-station and early-arriving U.S. Navy forces could be of particular value, while later-arriving U.S. Navy forces might be of less value, at least in preventing initial success by PLA forces.

On-Station Forces. Given the difficulty of knowing with certainty when a Taiwan Strait crisis or conflict might occur, having forces on-station at the start of the crisis or conflict is a goal that would most reliably be met by maintaining a standing forward deployment of U.S. Navy forces in the area. Maintaining a standing forward deployment of U.S. Navy forces in the area while also maintaining U.S. Navy forward deployments in other regions, such as the Persian Gulf/Indian Ocean region and the Mediterranean Sea, would require a Navy with a certain minimum number of ships.

Although it is sometimes said that it takes three U.S. Navy ships to keep one ship forward deployed in an overseas location, the actual ratio traditionally has been higher. For example, if U.S. Navy ships are operated in the traditional manner — with a single crew for each ship and deployments lasting six months — then maintaining one U.S. Navy cruiser or destroyer continuously forward-deployed to the

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[89] For discussions relating to Taiwan's potential military capabilities in such a scenario, see CRS Report RL30957, *Taiwan: Major U.S. Arms Sales Since 1990*; and CRS Report RL30341, *China/Taiwan: Evolution of the 'One China' Policy — Key Statements from Washington, Beijing, and Taipei*, both by Shirley A. Kan.

Western Pacific might require a total of about five San Diego-based cruisers or destroyers.[90]

Stationkeeping multipliers like these can be reduced by homeporting U.S. Navy ships at locations closer to Taiwan (such as Japan, Guam, Hawaii, or perhaps Singapore) or by deploying ships for longer periods of time and operating them with multiple crews that are rotated out to each ship. The Navy has an aircraft carrier strike group and other ships[91] homeported in Japan, and three attack submarines homeported in Guam.[92] The Navy reportedly may transfer an additional aircraft carrier from the continental United States to Hawaii or Guam, and is studying options for transferring perhaps a few additional SSNs to Hawaii or Guam. The Navy is also experimenting with the concept of deploying certain Navy ships (particularly surface combatants) for 12, 18, or 24 months and rotating multiple crews out to each ship.[93]

Early-Arriving Forces. Having early-arriving U.S. Navy forces could mean having forces based in locations Western Pacific locations such as Japan, Guam, Singapore, or perhaps Hawaii, rather than on the U.S. West Coast.[94] **Table 4** shows potential ship travel times to the Taiwan Strait area from various ports in the Pacific, based on average ship travel speeds. All the ports shown in the table except Singapore are current U.S. Navy home ports.[95] U.S. Navy submarines, aircraft carriers, cruisers, and destroyers have maximum sustained speeds of more than 30 knots, but their average speeds over longer transits in some cases might be closer to 25 knots or less due rough sea conditions or, in the case of the cruisers or destroyers, which are conventionally powered, the need slow down for at-sea refueling. The Navy's planned Littoral Combat Ship (LCS) is to have a maximum sustained speed of about 45 knots, but its average speed over long transits would likely be less than that.[96]

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[90] For a discussion, see archived CRS Report 92-803, *Naval Forward Deployments and the Size of the Navy*, by Ronald O'Rourke. See **Table 1**. (Out of print and available directly from the author.)

[91] The other ships include amphibious ships and mine countermeasures ships.

[92] One of these SSNs, the San Francisco, was significantly damaged in a collision with an undersea mountain near Guam in January 2005. The ship was transferred to the Puget Sound Naval Shipyard at Bremerton, WA, for repairs. The San Francisco reportedly will be replaced at Guam by another SSN, the Buffalo, in September 2006. (David V. Crisostomo, "Guam To Receive Third Home-Ported Submarine In 2006," *Pacific Daily News (Guam)*, November 1, 2005.)

[93] For a discussion see CRS Report RS21338, *Navy Ship Deployments: New Approaches — Background and Issues for Congress*, by Ronald O'Rourke.

[94] Other potential Western Pacific locations, at least in theory, include South Korea (where other U.S. forces have been based for years), the Philippines (where the U.S. Navy ships used as a major repair port until the early 1990s), and Australia.

[95] U.S. Navy ships visit Singapore, and there is a U.S. Navy logistic group there, but no U.S. Navy ships are currently homeported at Singapore.

[96] One version of the LCS has a sprint (i.e., high-speed) range of roughly 1,150 miles, while the other has a sprint range of about 1,940 miles.

Table 4. Potential Ship Travel Times to Taiwan Strait Area

Port	Straight-line distance to Taiwan Strait area[a] (nautical miles)	Minimum travel time in days, based on average speeds below[b]		
		20 knots	25 knots	30 knots
Yokosuka, Japan[c]	1,076	2.2	1.8	1.5
Guam	1,336	2.8	2.2	1.9
Singapore[d]	1,794	3.7	3.0	2.5
Pearl Harbor[e]	4,283	8.9	7.1	5.9
Everett, WA	5,223	10.9	8.7	7.3
San Diego	5,933	12.3	9.9	8.2

Source: Table prepared by CRS using straight-line distances calculated by the "how far is it" calculator, available at [http://www.indo.com/distance/].

a. Defined as a position in the sea at 24°N, 124°E, which is roughly 130 nautical miles *east* of Taiwan, i.e., on the other side of Taiwan from the Taiwan Strait.
b. Actual travel times may be greater due to the possible need for ships to depart from a straight-line course so as to avoid land barriers, remain within port-area shipping channels, etc.
c. Distance calculated from Tokyo, which is about 25 nautical miles north of Yokosuka.
d. No U.S. Navy ships are currently homeported at Singapore.
e. Distance calculated from Honolulu, which is about 6 nautical miles southeast of Pearl Harbor.

As can be seen in the table, Yokosuka, Guam, and Singapore are less than half as far from the Taiwan Strait area as are Pearl Harbor, Everett, WA,[97] and San Diego. Depending on their average travel speeds, ships homeported in Yokosuka, Guam, and Singapore could arrive in the Taiwan Strait area roughly two to four days after leaving port, ships homeported in Pearl Harbor might arrive about six to nine days after leaving port, and ships homeported on the U.S. West Coast might arrive about seven to twelve days after leaving port. The time needed to get a ship and its crew ready to leave port would add to their total response times. Depending on a ship's status at the moment it was ordered to the Taiwan Strait area, preparing it for rapid departure might require anywhere from less than one day to a few days.

Regarding the possible transfer of a carrier from the continental United States to Hawaii or Guam, one observer states:

> Currently the United States maintains one aircraft carrier full-time in the Western Pacific. In the event of a conflict with China over Taiwan, however, particularly given the various [PLA] threats to land-based air outlined above, having more aircraft carriers on the scene will be extremely valuable. Other than any carriers that might be transiting through the region, however, currently the closest additional carriers would be those based on the west coast of the United States. Given that a conflict with China could begin with little warning, this means that as much as two weeks could elapse before additional aircraft carriers reached the area of combat operations. The Department of Defense has already recommended forward-deploying an additional aircraft carrier in the Pacific, but

[97] Everett is located on the Puget Sound, about 23 nautical miles north of Seattle.

> it is important to note that precisely where this carrier is forward-deployed is significant. In particular, an aircraft carrier based in Hawaii would still take at least a week to reach waters near Taiwan. An aircraft carrier based in Guam, Singapore, or elsewhere in the Western Pacific, by contrast, could arrive on the scene in about three days.[98]

Basing additional forces in Japan, Guam, Singapore, or Hawaii could increase the importance of taking actions to defend these locations against potential attack by TBMs, LACMs, or special operations forces.[99]

Defeating PLA Anti-Access Forces. Defeating PLA maritime anti-access forces would require capabilities for countering:

- large numbers of TBMs, including some possibly equipped with MaRVs;
- large numbers of LACMs and ASCMs, including some advanced ASCMs such as the SS-N-27 and SS-N-22;
- substantial numbers of land-based fighters, strike fighters, maritime bombers, and SAMs, including some built to modern designs;
- a substantial number of submarines, including a few that are nuclear-powered and a significant portion that are built to modern designs;
- a substantial number of destroyers, frigates, and fast attack craft, including some built to modern designs; and
- potentially large numbers of mines of different types, including some advanced models.

Countering TBMs. Countering large numbers of TBMs, including some possibly equipped with MaRVs, could entail some or all of the following:

- operating, if possible, in a way that reduces the likelihood of being detected and tracked by PLA maritime surveillance systems;
- attacking the surveillance systems that detect and track U.S. Navy ships operating at sea, and the network that transmits this targeting data to the TBMs;
- attacking TBMs at their launch sites;

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[98] China's Military Modernization and the Cross-Strait Balance, [Statement of] Roger Cliff, September 2005, Testimony presented before the U.S.-China Economic and Security Review Commission on September 15, 2005, pp. 9-10. (Hereafter cited as *Cliff 9/15/05 testimony*.)

[99] For a list of recommended actions for improving the ability of bases in the Western Pacific to defend themselves from PLA attack, see *Cliff 9/15/05 testimony*.

- intercepting TBMs in flight, which in some cases could require firing two or perhaps even three interceptor missiles at individual TBMs to ensure their destruction;

- decoying MaRVs away from U.S. Navy ships.

Potential implications of the above points for Navy missile-defense programs are discussed in this next section of this report.

Countering Submarines. Countering a substantial number of submarines would likely require a coordinated effort by an ASW network consisting of some or all of the following: distributed sensors, unmanned vehicles, submarines, surface ships, helicopters, and maritime patrol aircraft. Defeating torpedoes fired by PLA submarines would require U.S. submarines and surface ships to have systems for detecting, decoying, and perhaps destroying those torpedoes.

ASW operations against well-maintained and well-operated submarines traditionally have often been time-consuming. Acoustic conditions in waters around Taiwan are reportedly poor for ASW, which could make the task of countering PLA submarines in these areas more difficult.[100] Success in an ASW operation is highly dependent on the proficiency of the people operating the ASW equipment. ASW operational proficiency can take time to develop and can atrophy significantly if not regularly exercised.

In December 2004, the Navy approved a new concept of operations (CONOPS) a new general approach — to ASW. As described in one article,

> The Navy's new concept of operations for anti-submarine warfare calls for the use of standoff weapons, networked sensor fields and unmanned vehicles to detect and attack diesel submarines in littoral waters, rather than a reliance on "force on force" engagements.
>
> Chief of Naval Operations Adm. Vern Clark approved the CONOPS Dec. 20, according to a Navy spokesman. The five-page document will guide the development of a comprehensive ASW master plan that is expected to be classified, though it might have an unclassified version.
>
> The CONOPS envisions hundreds or thousands of small sensors that would "permeate the operating environment, yielding unprecedented situational awareness and highly detailed pictures of the battlespace." Attack submarines that today carry sensors and weapons could in the future provide logistical support to and serve as command and control bases for off-board sensors and "kill vehicles," the CONOPS states. The networking of autonomous sensor

[100] See, for example, the statement of Lyle J. Goldstein in *2/6/04 USCC hearing*, pp. 148, 150, and 152.

fields with manned and unmanned vehicles will change ASW from a "platform-intensive" to a "sensor-rich" operation, it adds.[101]

At a June 20, 2005, conference on the future of the Navy organized by the American Enterprise Institute (AEI), Admiral Vernon Clark, who was the Chief of Naval Operations until July 22, 2005, stated:

> [The Chinese are] building submarines at a rapid rate. They're buying them from other countries. They're building their own capabilities. And let me just to make a long story short, I published a new ASW concept [of operations] a couple of months ago. I fundamentally don't believe that the old attrition warfare[,] force on force anti-submarine warfare[,] construct is the right way to go in the 21st century. [The questioner] mentioned that I had spent part of my past life in the submarine warfare business. I have. I trailed the Soviets around. I know what that's about. And what I really believe is going to happen in the future is that when we apply the netted force construct in anti-submarine warfare, it will change the calculus in that area of warfighting forever. And it will be a courageous commander who decides that he's going to come waltzing into our network.[102]

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[101] Jason Ma, "ASW Concept Of Operations Sees 'Sensor Rich Way Of Fighting Subs," *Inside the Navy*, February 7, 2005. A January 2005 article stated:

> The Navy cannot fight diesel subs with "force on force," such as sending one sub to defeat another sub, because that is not cost effective, [Rear Admiral John Waickwicz, chief of Fleet Anti-Submarine Warfare Command] told *Inside the Navy*. For example, the new Virginia-class subs cost about $2 billion each, while advanced diesel subs cost hundreds of millions of dollars each.
>
> Instead of force on force, ASW tactics will emphasize using networked sensors and communications to allow one platform — like a sub, Littoral Combat Ship, or aircraft — to defeat multiple diesel subs, he said. "You have to be able to destroy them at a very large rate, because potential enemies may have a large number" of subs, he explained.
>
> "We don't have that luxury to go one against one anymore," he added, noting that individual ASW platforms will rely on their greater capability to take on multiple subs. (Jason Ma, "Admiral: Navy's ASW Tactics To Be Aggressive And Offense-Minded," *Inside the Navy*, January 17, 2005.)

[102] Transcript of conference, as posted on the Internet by AEI at [http://www.aei.org/events/filter.all,eventID.1051/transcript.asp].

An October 2004 article stated:

> more than just improving antisubmarine operations, Clark's goal is to "fundamentally change" ASW operations away from individual platforms — ship, submarine or aircraft — to a system with the attributes of "pervasive awareness, persistence and speed, all enabled by technological agility."
>
> To meet this goal, "we think we're going to have to go offboard of our platforms," using unmanned aerial, surface and underwater vehicles, and a network of distributed sensors to provide the identification and localization that would allow quick transition to the attack, [Rear Admiral Mark W. Kenny, the

Implementing this new ASW concept of operations reportedly will require overcoming some technical challenges, particularly with regard to linking together large numbers of distributed sensors, some of which might be sonobuoys as small as soda cans.[103]

Countering Mines. Countering naval mines is a notoriously time-consuming task that can require meticulous operations by participating surface ships, submarines, and helicopters. The Navy's mine countermeasures (MCM) capabilities have been an area of concern in Congress and elsewhere for a number of years.[104] The Navy for the last several years has been developing several new MCM systems that are scheduled to enter service over the next few years.[105] Unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs) are playing an increasing role in MCM operations.

Operating Amidst IW/IO, EMP, And Nuclear Weapons. Operating effectively in an environment that could be characterized by IW/IO and possibly

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> flag officer in charge of Task Force ASW] said. "That's what we're focused on: (finding) a high number of quiet contacts in a demanding environment with a timeline that requires us to gain access quickly."
>
> The task force has tested those concepts in at-sea experiments focused on distributive systems, which could be an array of easily deployed underwater sensors, passive and active, networked together and linked to manned platforms, he explained.
>
> Among them is the Advanced Deployable System, which the Program Executive Office for Integrated Warfare Systems currently is studying, along with such other ASW-related concepts as a multisensor Torpedo Recognition and Alertment Function Segment (previously known as Torpedo Recognition and Alertment Function Processor) and the Multifunction Towed Array to improve detection and tracking capability. (Otto Kreisher, "As Underwater Threat Re-Emerges, Navy Renews Emphasis On ASW," *Seapower*, October 2004, p. 15.)

[103] 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.

[104] See, for example, General Accounting Office, *Navy Acquisitions[:] Improved Littoral War-Fighting Capabilities Needed*, GAO-01-493, May 2001; and General Accounting Office, *Navy Mine Warfare[:] Plans to Improve Countermeasures Capabilities Unclear*, GAO/NSIAD-98-135, June 1998.

[105] The Navy's mine warfare plan is available on the Internet at [http://www.exwar.org/Htm/4000.htm]. For additional discussions of the Navy's mine warfare programs, see Department of the Navy, *Highlights of the Department of the Navy FY2006/FY2007 Budget*, Washington, 2005. (Office of Budget, February 2005) pp. 5-9; Richard R. Burgess, "New Mine Countermeasure System Designs Are Hitting the Water," *Seapower*, August 2005, p. 46, 48; Jason Ma, "Fielding Of Organic Mine Warfare Systems Slips At Least Two Years," *Inside the Navy*, March 21, 2005; William E. Landay III and Hunter C. Keeter, "Breaking the Mold," *Seapower*, March 2005, pp. 42, 44, 46; Scott C. Truver, "Mine Countermeasures And Destruction," *Naval Forces*, No. 3, 2004, pp. 63-64, 66-71; Glenn W. Goodman, Jr., "Organic Mine Countermeasures To Clear Path For Navy," *Armed Forces Journal*, January 2004, p. 36.

EMP or the use of nuclear weapons directly against Navy ships could require, among other things:

- measures to achieve and maintain strong computer network security;
- hardening of ships, aircraft, and their various systems against EMP; and
- hardening of ships against the overpressure, thermal, and radiation effects of a nuclear weapon that is detonated somewhat close to the ship, but not close enough to destroy the ship outright.

Forces Ready by About 2010, or by a Later Date. As mentioned earlier, some analysts speculate that China may attain (or believe that is has attained) a capable maritime anti-access capability, or important elements of it, by about 2010, while other observers believe this will happen some time after 2010. The issue of whether or when China might attain such a capability can influence the kinds of options that are available to U.S. policymakers for addressing the situation.

Options for a Conflict Between Now and 2010. Options that could enhance U.S. Navy capabilities for a crisis or conflict in the Taiwan Strait area between now and 2010 include, among others, the following:

- increasing currently planned activities for physically surveying the physical environment around Taiwan, so as to more quickly update older data that might unreliable, and to fill in any gaps in understanding regarding how local atmospheric and water conditions might affect the performance of radars and sonars;
- increasing currently planned levels of monitoring and surveillance of PLA forces that are likely to participate in a crisis or conflict in the Taiwan Strait area;
- increasing currently planned levels of contact between the U.S. Navy and Taiwan military forces, so as to maintain a fully up-to-date U.S. understanding of Taiwan military capabilities, plans, and doctrine (and vice versa);
- increasing currently planned military exercises that are tailored to the potential requirements of a crisis or conflict in the Taiwan Strait area;
- increasing the number of ships that are assigned to the Pacific Fleet, or the number that are forward-homeported at locations such as Japan, Guam, Hawaii, and perhaps Singapore, or the numbers of both;
- deferring current plans for retiring existing ships or aircraft before 2010, particularly ships and aircraft whose nominal service lives would otherwise extend to 2010 or beyond;

- modernizing ships and aircraft now in service;
- reactivating recently retired ships and aircraft;[106] and
- procuring new items that can be completed between now and 2010, such as weapons, aircraft, and Littoral Combat Ships (LCSs).

Options For A Conflict After 2010. Options that could enhance U.S. Navy capabilities for a crisis or conflict in the Taiwan Strait area some time after 2010 include items from the above list, plus the procurement of larger ships that take several years to build (e.g., SSNs, aircraft carriers, destroyers, and cruisers), and the development and procurement of aircraft and weapons that are not currently ready for procurement.

Capabilities for Maintaining Regional Presence and Influence. For the U.S. Navy, maintaining regional presence and military influence in the Western Pacific could place a premium on the following, among other things:

- maintaining a substantial U.S. Navy ship presence throughout the region;
- making frequent port calls in the region;
- conducting frequent exercises with other navies in the region;
- taking actions to ensure system compatibility between U.S. Navy ships and ships of allied and friendly nations in the region; and
- conducting frequent exchanges between U.S. Navy personnel and military and political leaders of other countries in the region.

Factors influencing the Navy's ability to maintain a substantial U.S. Navy ship presence throughout the region include the total number of ships in the Navy's Pacific Fleet, the number of Navy ships forward-homeported at locations such as Japan, Guam, Hawaii, and perhaps Singapore, and ship-crewing and -deployment approaches (e.g., six-month deployments and single crews vs. longer deployments with crew rotation).

Capabilities for Tracking and Countering PLA SSBNs. Detecting, tracking, and if necessary countering PLA Navy SSBNs equipped with long-range SLBMs could require some or all of the following:

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[106] Potential candidates include, among others, Spruance (DD-963) class destroyers, which could be reactivated as ASW platforms or missile shooters, Oliver Hazard Perry (FFG-7) class frigates and TAGOS-type ocean surveillance (i.e., towed-array sonar) ships, both of which could be reactivated as ASW platforms, and ASW-capable aircraft such as S-3 carrier-based airplanes and P-3 land-based maritime patrol aircraft.

- a seabed-based sensor network analogous to the Sound Surveillance System (SOSUS) that the U.S. Navy used during the Cold War to detect and track Soviet nuclear-powered submarines;

- ocean surveillance ships with additional sonars, which would be similar to the TAGOS-type ocean-surveillance ships that the Navy also used during the Cold War to help detect and track Soviet nuclear-powered submarines; and

- enough SSNs so that some can be assigned to tracking and if necessary attacking PLA SSBNs.[107]

Potential Oversight Issues For Congress

Potential oversight questions for Congress arising from China's military modernization and its potential implications for required U.S. Navy capabilities can be organized into three groups:

- questions relating to China's military modernization as a defense-planning priority;

- questions relating to U.S. Navy force structure and basing arrangements; and

- questions relating to Navy warfare areas and programs.

Each of these is discussed below.

China as a Defense-Planning Priority

DOD Planning. *Is DOD giving adequate weight in the 2005 Quadrennial Defense Review (QDR) and other planning activities to China's military modernization as opposed to other concerns, such as current operations in Iraq and Afghanistan and the global war on terrorism (GWOT) generally? Is DOD giving adequate weight in its planning to the funding needs of the Navy as opposed to those of the other services, such as the Army?*

Operations in Iraq and Afghanistan have led to increased focus on the funding needs of the Army and Marine Corps, since these two services are heavily committed to those operations. Placing increasing emphasis on China in DOD planning, on the other hand, would likely lead to increased focus on the funding needs of the Navy and Air Force, since these two services are generally viewed as the ones most likely to be of the most importance for a crisis or conflict in the Taiwan Strait area. In a situation of finite DOD resources, striking the correct planning balance between

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[107] Additional measures that could assist in tracking PLA SSBNs include satellite surveillance (particularly when the SSBNs are in port or if they surface during their deployments) and human intelligence.

operations in Iraq and Afghanistan and the GWOT generally, and China's military modernization is viewed by some observers as a key DOD planning challenge.

Navy Planning. *Is the Navy is giving adequate weight in its planning to China's military modernization as opposed to other concerns, such as the GWOT?*

Required Navy capabilities for participating in the GWOT overlap with, but are not identical to, required Navy capabilities for responding to China's naval modernization. In a situation of finite Navy resources, striking the correct balance between investments for participating in the GWOT and those for responding to China's naval modernization is viewed by some observers as a key Navy planning challenge.

The Navy in recent months has taken some actions that reflect an interest in increasing the Navy's role in the GWOT. In June 2005, Admiral Vernon Clark, who was the Chief of Naval Operations until July 22, 2005, directed the Navy to take nine "actions to expand the Navy's capabilities to prosecute the GWOT..." Among these are the establishment of a Navy riverine force, the establishment of a reserve civil affairs battalion, the establishment of a Foreign Area Office (FAO) community in the Navy, and concept development work for a potential Navy expeditionary combat battalion composed of sailors rather than Marines. "To the extent possible," the Navy wants to implement these actions without increasing Navy active and reserve end strength.[108] On October 1, 2005, the Navy established a new Expeditionary Combat Command to oversee certain Navy organizations whose activities contribute to the Navy's role in the GWOT.[109] Also in October 2005, Admiral Clark's successor as CNO, Admiral Michael Mullen, issued a guidance statement for the Navy for 2006 that contained follow-on initiatives intended to strengthen the Navy's role in the GWOT.[110] The Navy has also commissioned a study from the Naval Studies Board

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[108] See July 12, 2005 memorandum for distribution from Director, Navy Staff on implementation of Chief of Naval Operations (CNO) guidance — global war on terrorism (GWOT) capabilities, posted in the "Defense Plus" section of [http://www.insidedefense.com]. See also, Andrew Scutro, "Navy To Establish Expeditionary And Riverine Forces," *NavyTimes.com*, July 7, 2005; Jason Sherman, "Navy To Establish Ground Combat Units, River Force For Terror War," *Inside the Navy*, July 11, 2005; Jason Ma, "For War On Terror, Navy Could Field New 'SOF-Lite Ground Troops," July 18, 2005; Christian Lowe, "U.S. Navy Considers New Combat Battalion," *Defense News*, July 25, 2005; "Navy Creates Riverines, Landing Unit To Lighten Marine, Army Force Load," *Seapower*, August 2005, pp. 6-7.

[109] Christopher J. Castelli, "Top Navy, SOCOM Leaders Discuss Key Issues, Resources And Roles," *Inside the Navy*, December 5, 2005; Otto Kreisher, "Navy's New Command Distances It More From Cold War," *San Diego Union Tribune*, December 3, 2005; Geoff Fein, "Naval Expeditionary Combat Command Aligns Forces For GWOT," *Defense Daily*, November 16, 2005.

[110] M. G. Mullen, *CNO Guidance for 2006, Meeting the Challenge of a New Era*. Washington, 2005. 9 pp.

(an arm of the National Academy of Sciences) on the adequacy of the role of naval forces in the GWOT and options for enhancing that role.[111]

At the same time, the Navy has affirmed the importance of China's military modernization in its budget planning. At a June 20, 2005 conference on the future of the Navy organized by the American Enterprise Institute (AEI), for example, Admiral Clark was asked to comment on China. He stated in part:

> Well, I think that, you know, we're always quick to point out that China's not our enemy, but China is building a very capable maritime capability, and so we should not be blind to that.
>
> So what does it mean? Well, here's what I believe that it means. I believe that if you study the Chinese, you see that there's been some change in their thinking over the course of the last number of years. Here's this mammoth land, continent; here's — you know, it would be easy to think about this country as being land-centric in terms of its national security focus, but what we're seeing is that that really isn't where they're putting their money. They're putting their investments in, and what it looks like, if you interpret their actions, is that their primary concerns are in the area of aviation and maritime capability that other nations would bring to bear in their area, in their region of the world. And so they're trying to build a capability to make sure that they're not pushed into a corner in their own part of the world.
>
> I understand that this morning there was conjecture about their ability to build missile systems that will threaten long-range land bases and moving targets in the future, like ships at sea. And I will tell you that whether they're going to do that or not, I guarantee you that I believe that it is my duty and responsibility to expect that, based on what I understand about what they're doing, to expect that they're trying to do that. And I will tell you that the budget submit that's on the Hill is providing the kind of capability to make sure that the United States Navy can fight in that theater or exist in that theater, understanding the kind of capability that they're trying to bring to bear.[112]

Navy Force Structure and Basing Arrangements

Size of the Fleet. *Is the Navy planning a fleet with enough ships to address potential challenges posed by China's naval modernization while also meeting other responsibilities?*

As of December 15, 2005, the Navy included a total of 281 ships of various kinds. In early December 2005, it was reported that the Navy is proposing to maintain in coming years a fleet of 313 ships.[113] In assessing the adequacy of the

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[111] Christopher J. Castelli, "Navy Commissions Study On 'Adequacy' Of Naval Role In War On Terror," *Inside the Navy*, July 11, 2005.

[112] Transcript of conference, as posted on the Internet by AEI at [http://www.aei.org/events/filter.all,eventID.1051/transcript.asp].

[113] For a detailed discussion, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

313-ship proposal, a key potential issue for Congress is whether it includes enough ships to address potential challenges posed by China's naval modernization while also meeting other responsibilities, including maintaining forward deployments of Navy ships in the Persian Gulf/Indian Ocean region and the Mediterranean Sea and conducting less-frequent operations in other parts of the world, such as the Caribbean, the waters around South America, and the waters off West Africa. If increased numbers of Navy ships are needed to address potential challenges posed by China's naval modernization, fewer ships might be available for meeting other responsibilities.

Some Members of Congress have expressed concern in recent years that the declining total number of ships in the Navy may make it difficult for the Navy to perform all if its various missions, at least not without putting undue stress on Navy personnel and equipment. In response, Navy officials in recent years have argued that the total number of ships in the Navy is no longer, by itself, a very good measure of total Navy capability over time, because of the significant increase in individual Navy ship and aircraft capabilities in recent years and the effect that computer networking technology has on further increasing the collective capability of Navy ships and aircraft. Navy officials acknowledge, however, that ship numbers are one factor in understanding Navy capabilities, particularly for conducting simultaneous operations of different kinds in multiple locations around the world.

Division of Fleet Between Atlantic and Pacific. *Should a greater percentage of the Navy be assigned to the Pacific Fleet?* The division of the Navy's ships between the Atlantic and Pacific fleets is a longstanding question in U.S. Navy planning. Atlantic Fleet ships conduct operations in the North and South Atlantic, the Caribbean, and the Mediterranean Sea, while Pacific Fleet ships conduct operations in the Pacific Ocean, including the Western Pacific. Ships from both fleets are used to conduct operations in the Persian Gulf/Indian Ocean area. Atlantic Fleet ships homeported on the U.S. East Coast that use the Suez Canal have a shorter transit distance to the Persian Gulf than do Pacific Fleet ships homeported on the U.S. West Coast.

In recent years, roughly 45% to 47% of the Navy's ships have been assigned to the Pacific Fleet, including 46% to 50% of the Navy's SSNs and 45% to 48% of the Navy's cruisers, destroyers, and frigates. Increasing the share of the Navy assigned to the Pacific Fleet could, other things held equal, permit the Navy to maintain a larger number of ships forward deployed to the Western Pacific. Using the size of the Navy as of the end of FY2005 (282 ships, including 54 SSNs and 99 cruisers, destroyers, and frigates), increasing the Pacific Fleet's share by 5 or 10 percentage points would result in the Pacific fleet having an additional 14 to 28 ships, including roughly 3 to 5 SSNs and roughly 5 to 10 to cruisers, destroyers, and frigates.

In recent years, 7 of the Navy's 12 aircraft carriers have been assigned to the Atlantic Fleet and 5 have been assigned to the Pacific Fleet. This division reflects in part a program currently underway to conduct a mid-life nuclear refueling complex overhaul (RCOH) on each of the Navy's nuclear-powered carriers. This program results, at any given moment, in one nuclear-powered carrier being homeported at Newport News, VA, the location of the shipyard where the work is conducted. Absent the nuclear carrier RCOH program, the division of carriers between the

Atlantic and Pacific might be 6 and 6, respectively, rather than 7 and 5. Whether the division of carriers between the two fleets is 7 and 5 or 6 and 6, shifting one carrier from the Atlantic to the Pacific would increase the Pacific Fleet's share of the carrier force by about 8 percentage points.

Supporters of shifting a greater share of the Navy to the Pacific Fleet could argue that responding to China's naval modernization requires, among other things, maintaining an increased number of ships forward deployed to the Western Pacific, and that the low likelihood of war in Europe and the ability of U.S. allies in Europe to deploy their own ships to the Mediterranean reduces the number of ships that the Navy needs to maintain there. Opponents of this option could argue that shifting Navy ships from the U.S. East Coast to the U.S. West Coast could make it harder to maintain deployments of a given number of ships to the Persian Gulf (due to the increase in transit distance to the Gulf for ships transferred from the East Coast to the West Coast) and could make it more difficult for the Navy to balance the maintenance demands of the fleet against the locations of repair and overhaul yards, many of which are located on the Atlantic and Gulf coasts.

Forward Homeporting in the Western Pacific. *Is the Navy moving quickly enough to forward-homeport additional ships in the Western Pacific? Should the Navy expand the number of additional ships it is thinking of homeporting in the area?*

Increasing the number of ships forward homeported in the Western Pacific can increase both the number of ships that the Navy can maintain forward-deployed to that area on a day to day basis, and the number that can arrive in the early stages of a conflict in the Western Pacific, including the Taiwan Strait area. As mentioned earlier, the Navy may transfer an additional aircraft carrier from the continental United States to Hawaii or Guam, and is studying options for transferring perhaps a few additional SSNs to Hawaii or Guam. Observers who are concerned about deterring or responding to a conflict in the Taiwan Strait area by 2010 might emphasize the importance of implementing these actions as quickly as possible.

In addition, observers concerned about China's military modernization might argue in favor of expanding the number of ships to be transferred to Western Pacific home ports. These additional ships could include SSNs, converted Trident cruise missile submarines (SSGNs), surface combatants, and perhaps one more aircraft carrier (i.e., a carrier beyond the one that the Navy reportedly is already considering transferring to Hawaii or Guam). The final report of the 2001 Quadrennial Defense Review (QDR) stated that "The Secretary of the Navy will increase aircraft carrier battlegroup presence in the Western Pacific and will explore options for homeporting an additional three to four surface combatants, and guided missile submarines (SSGNs), in that area.[114] A 2002 Congressional Budget Office (CBO) report discussed the option of homeporting a total of up to 11 SSNs at Guam.[115] Expanding

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[114] U.S. Department of Defense, *Quadrennial Defense Review Report*, Washington, 2001 (September 30, 2001) p. 27.

[115] U.S. Congressional Budget Office, *Increasing the Mission Capability of the Attack Submarine Force*, Washington, CBO, 2002. (A CBO Study, March 2002), 41 pp.

the number of ships to be homeported in the Western Pacific could require construction of additional homeporting facilities, particularly in locations such as Guam. Transferring ships from the U.S. West Coast to the Western Pacific can also have implications for crew training and ship maintenance for those ships.

Number of Aircraft Carriers. *Should the Navy maintain a force of 12 carriers, or a smaller number?* As part of its FY2006 budget submission, the Navy proposed accelerating the retirement of the aircraft carrier John F. Kennedy (CV-67) to FY2006 and reducing the size of the carrier force from 12 ships to 11. The Navy's reported proposal for a 313-ship fleet reportedly includes 11 carriers. The issue of how many carriers the Navy should operate is discussed at some length in another CRS report.[116] Advocates of maintaining a force of not less than 12 carriers could argue that, in light of China's naval modernization, including the introduction of new land-based fighters and strike fighters and the possibility that the PLA might, as part of a conflict in the Taiwan Strait area, use TBMs, LACMs, or special operations forces to attack U.S. land bases in the Western Pacific, a force of at least 12 carriers is needed to deter or prevail in such a conflict. Those supporting a reduction in the carrier force to 11 or fewer ships could argue that such a reduction is acceptable in light of the increasing capabilities of individual Navy carrier air wings, the Navy's plan to transfer an additional carrier to the Western Pacific, and options for improving the defenses of U.S. bases in the Western Pacific against attack from TBMs, LACMs, and special operations forces.

Number of Attack Submarines (SSNs). *Should the number of nuclear-powered attack submarines be about 40, about 55, or some other number?* The Navy at the end of FY2005 operated a total of 54 SSNs. The Navy's reported proposal for a 313-ship fleet reportedly includes 48 SSNs (plus four converted Trident cruise missile submarines, or SSGNs). The issue of the SSN force-level goal is discussed at length in another CRS report.[117]

Supporters of SSNs have argued in recent months that China's naval modernization, and in particular China's submarine modernization, is a significant reason for supporting a force of 55 or more SSNs. The argument was an element of the successful campaign in 2005 by supporters of the New London, CT, submarine base to convince the Base Realignment and Closure (BRAC) to reject DOD's recommendation to close the base.[118]

Although the discussion is sometimes cast in terms of U.S. SSNs fighting PLA Navy submarines, this captures only a part of how U.S. SSNs would fit into potential

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[116] CRS Report RL32731, *Navy Aircraft Carriers: Proposed Retirement of USS John F. Kennedy — Issues and Options for Congress*, by Ronald O'Rourke.

[117] CRS Report RL32418, *Navy Attack Submarine Force-Level Goal and Procurement Rate: Background and Issues for Congress*, by Ronald O'Rourke.

[118] See, for example, Chris Johnson, "Lawmaker Points To China Buildup In Effort To Protect Sub Base," *Inside the Navy*, August 1, 2005; Anthony Cronin, "Hunter Says China Bolsters Case To Keep Sub Base Open," *New London (CT) Day*, June 28, 2005; William Yardley, "If Bases Aren't Needed, Some Fear Fleet Is Next," *New York Times*, August 22, 2005.

U.S. Navy operations against PLA forces. On the one hand, ASW is conducted by platforms other than SSNs, and an SSN is not always the best platform for countering an enemy submarine. On the other hand, SSNs perform a number of potentially significant missions other than ASW.

Supporters of maintaining more than 48 SSNs in light of China's naval modernization could argue that, in addition to participating in operations against PLA Navy submarines, U.S. SSNs could do the following:

- **Conduct pre-crisis covert intelligence, surveillance, and reconnaissance (ISR) of PLA Navy forces and bases.** Such operations could improve U.S. understanding PLA capabilities and weaknesses.

- **Covertly lay mines around China's naval bases.** In light of the PLA Navy's limited mine countermeasures capabilities, the presence of mines around PLA Navy bases could significantly delay the deployment of PLA Navy forces at the outset of a crisis or conflict.

- **Attack or threaten PLA Navy surface ships.** In light of the PLA Navy's limitations in ASW, a threat from U.S. SSNs could substantially complicate PLA military planning, particularly for an intended short-duration conflict.

- **Fire Tomahawk cruise missiles from unexpected locations.** Tomahawks could be used to attack on PLA command and control nodes, air bases, and TBM, LACM, ASCM, and SAM launch sites.

- **Covertly insert and recover special operations forces (SOF).** SOF can be used to attack PLA Navy bases or other PLA coastal facilities.

Supporters of maintaining more than 48 SSNs could also argue that submerged U.S. SSNs cannot be attacked by conventionally armed TBMs and ASCMs and are less vulnerable than are U.S. Navy surface ships to EMP effects and to certain other nuclear weapon effects.

Supporters of maintaining 48 or fewer SSNs could argue that U.S. SSNs, though very capable in certain respects, are less capable in others. U.S. SSNs, they can argue, cannot shoot down enemy missiles or aircraft, nor can they act as platforms for operating manned aircraft. U.S. cruisers and destroyers, they could argue, carry substantial numbers of Tomahawks. In light of the complementary capabilities of Navy platforms and the need for an array of U.S. Navy capabilities in operations against PLA forces, they could argue, the need for SSNs needs to be balanced against the need for aircraft carriers and surface combatants.

ASW-Capable Ships and Aircraft. *Will the Navy have enough ASW-capable ships and aircraft between now and 2010? Should recently deactivated ASW-capable ships and aircraft be returned to service?* The Navy in recent years has deactivated a substantial number of ASW-capable ships and aircraft, including

Spruance (DD-963) class destroyers, Oliver Hazard Perry (FFG-7) class frigates, TAGOS-type ocean surveillance ships, carrier-based S-3 airplanes, and land-based P-3 maritime patrol aircraft. Since ASW traditionally has been a platform-intensive undertaking — meaning that a significant number of platforms (e.g., ships and aircraft) traditionally has been required to conduct an effective ASW operation against a small number of enemy submarines, or even a single submarine — some observers have expressed concern about the resulting decline in numbers of U.S. Navy ASW-capable platforms.[119]

As discussed earlier, the Navy plans to shift to a new, less platform-intensive ASW concept of operations. The Navy also plans to introduce new ASW-capable platforms in coming years, including Littoral Combat Ships (LCSs). The Navy's reported proposal for a 313-ship fleet reportedly includes 55 LCSs. Fully realizing the new ASW concept of operations, however, may take some time, particularly in light of the technical challenges involved, and LCSs will not be available in large numbers until after 2010. This raises a potential question of whether the Navy will have enough ASW-capable ships and aircraft between now and 2010, and whether the Navy should reactivate recently retired ASW-capable platforms and keep them in service until the new ASW concept is substantially implemented and larger numbers of LCSs and other new ASW-capable platforms join the fleet.

Advocates of this option could argue that the recent retirements of ASW-capable platforms occurred before the dimensions of the PLA Navy submarine modernization effort were fully understood. Opponents could argue that even with these recent retirements, the Navy retains a substantial number of such platforms, including SSNs, Aegis cruisers and destroyers, remaining Oliver Hazard Perry (FFG-7) class frigates, carrier- and surface combatant-based SH-60 helicopters, and remaining P-3s. They could also argue that there are more cost-effective ways to improve the Navy's ASW capabilities between now and 2010, such as increased ASW training and exercises (see discussion below).

Navy Warfare Areas and Programs

Missile Defense.

Replacement for NAD Program.[120] *Should the canceled Navy Area Defense (NAD) program be replaced with a new sea-based terminal missile defense program?*

In December 2001, DOD announced that it had canceled the Navy Area Defense (NAD) program, the program that was being pursued as the Sea-Based Terminal portion of the Administration's overall missile-defense effort. (The NAD program was also sometimes called the Navy Lower Tier program.) In announcing its

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[119] See, for example, John R. Benedict, "The Unraveling And Revitalization Of U.S. Navy Antisubmarine Warfare," *Naval War College Review*, spring 2005, pp. 93-120, particularly pp. 104-106; and the statement by Lyle J. Goldstein in *2/6/04 USCC hearing*, pp. 149-150.

[120] This section includes material adapted from the discussion of the NAD program in CRS Report RL31111, *Missile Defense: The Current Debate*, coordinated by Steven A. Hildreth.

decision, DOD cited poor performance, significant cost overruns, and substantial development delays.

The NAD system was to have been deployed on Navy Aegis cruisers and destroyers. It was designed to intercept short- and medium-range theater ballistic missiles in the final, or descent, phase of flight, so as to provide local-area defense of U.S. ships and friendly forces, ports, airfields, and other critical assets ashore. The program involved modifying both the Aegis ships' radar capabilities and the Standard SM-2 Block IV air-defense missile fired by Aegis ships. The missile, as modified, was called the Block IVA version. The system was designed to intercept descending missiles within the Earth's atmosphere (endoatmospheric intercept) and destroy them with the Block IVA missile's blast-fragmentation warhead.

Following cancellation of the program, DOD officials stated that the requirement for a sea-based terminal system remained intact. This led some observers to believe that a replacement for the NAD program might be initiated. In May 2002, however, DOD announced that instead of starting a replacement program, MDA had instead decided on a two-part strategy to (1) modify the Standard SM-3 missile — the missile to be used in the sea-based midcourse (i.e., Upper Tier) program — to intercept ballistic missiles at somewhat lower altitudes, and (2) modify the SM-2 Block four air defense missile (i.e., a missile designed to shoot down aircraft and cruise missiles) to cover some of the remaining portion of the sea-based terminal defense requirement. DOD officials said the two modified missiles could together provide much (but not all) of the capability that was to have been provided by the NAD program. One aim of the modification strategy, DOD officials suggested, was to avoid the added costs to the missile defense program of starting a replacement sea-based terminal defense program.

In October 2002, it was reported that

> Senior navy officials, however, continue to speak of the need for a sea-based terminal BMD capability "sooner rather than later" and have proposed a path to get there. "The cancellation of the Navy Area missile defence programme left a huge hole in our developing basket of missile-defence capabilities," said Adm. [Michael] Mullen. "Cancelling the programme didn't eliminate the warfighting requirement."
>
> "The nation, not just the navy, needs a sea-based area missile defence capability, not to protect our ships as much as to protect our forces ashore, airports and seaports of debarkation" and critical overseas infrastructure including protection of friends and allies.[121]

The above-quoted Admiral Mullen became the Chief of Naval Operations (CNO) on July 22, 2005.

In light of PLA TBM modernization efforts, including the possibility of TBMs equipped with MaRVs capable of hitting moving ships at sea, one issue is whether

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[121] Michael Sirak, "Sea-Based Ballistic Missile Defence: The 'Standard' Response," *Jane's Defence Weekly*, October 30, 2002.

a new sea-based terminal-defense procurement program should be started to replace all (not just most) of the capability that was to have been provided by the NAD program, and perhaps even improve on the NAD's planned capability. In July 2004 it was reported that

> The Navy's senior leadership is rebuilding the case for a sea-based terminal missile defense requirement that would protect U.S. forces flowing through foreign ports and Navy ships from short-range missiles, according to Vice Adm. John Nathman, the Navy's top requirements advocate.
>
> The new requirement, Nathman said, would fill the gap left when the Pentagon terminated the Navy Area missile defense program in December 2001. ... However, he emphasized the Navy is not looking to reinstate the old [NAD] system. "That's exactly what we are not talking about," he said March 24....
>
> The need to bring back a terminal missile defense program was made clear after reviewing the "analytic case" for the requirement, he said. Though Nathman could only talk in general terms about the analysis, due to its classified nature, he said its primary focus was "pacing the threat" issues. Such issues involve threats that are not a concern today, but could be in the future, he said. Part of the purpose of the study was to look at the potential time line for those threats and the regions where they could emerge.[122]

Reported options for a NAD-replacement program include a system using a modified version of the Army's Patriot Advanced Capability-3 (PAC-3) interceptor or a system using a modified version of the Navy's new Standard Missile 6 Extended Range Active Missile (SM-6 ERAM) air defense missile.[123]

Aegis Radar Upgrades. *Should the radar capabilities of the Navy's Aegis cruisers and destroyers be upgraded more quickly or extensively than now planned?*

Current plans for upgrading the radar capabilities of the Navy's Aegis cruisers and destroyers include the Aegis ballistic missile defense signal processor (BSP), which forms part of the planned Block 06 version of the Navy's Aegis ballistic missile defense capability. Installing the Aegis BSP improves the ballistic missile target-discrimination performance of the Aegis ship's SPY-1 phased array radar.

In light of PLA TBM modernization efforts, including the possibility of TBMs equipped with MaRVs capable of hitting moving ships at sea, one issue is whether current plans for developing and installing the Aegis BSP are adequate, and whether those plans are sufficiently funded. A second issue is whether there are other opportunities for improving the radar capabilities of the Navy's Aegis cruisers and

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[122] Malina Brown, "Navy Rebuilding Case For Terminal Missile Defense Requirement," *Inside the Navy*, April 19, 2004.

[123] See, for example, Jason Ma and Christopher J. Castelli, "Adaptation Of PAC-3 For Sea-Based Terminal Missile Defense Examined," *Inside the Navy*, July 19, 2004; Malina Brown, "Navy Rebuilding Case For Terminal Missile Defense Requirement," *Inside the Navy*, April 19, 2004.

destroyers that are not currently being pursued or are funded at limited levels, and if so, whether funding for these efforts should be increased.

Ships with DD(X)/CG(X) Radar Capabilities. *Should planned annual procurement rates for ships with DD(X)/CG(X) radar capabilities be increased?*

The Navy plans to procure a new kind of destroyer called the DD(X) and a new kind of cruiser called the CG(X). The Navy plans to begin DD(X) procurement in FY2007, and CG(X) procurement in FY2011. The Navy had earlier planned to begin CG(X) procurement in FY2018, but accelerated the planned start of procurement to FY2011 as part of its FY2006-FY2011 Future Years Defense Plan (FYDP). The first two DD(X)s, if procured in FY2007, might enter service in 2013, and the first CG(X), if procured in FY2011, might enter service in 2017.

The Navy states that the DD(X)'s radar capabilities will be greater in certain respects than those of Navy Aegis ships. The radar capabilities of the CG(X) are to be greater still, and the CG(X) has been justified primarily in connection with future air and missile defense operations.

The Navy's estimate of DD(X)/CG(X) procurement costs increased substantially between 2004 and 2005. Apparently as a consequence of this increase, the FY2006-FY2011 FYDP submitted to Congress in early 2005 reduced planned DD(X) procurement to one ship per year for the period FY2007-FY2011. Some observers, including the Congressional Budget Office (CBO) and, reportedly, the Cost Analysis Improvement Group (CAIG) within the Office of the Secretary of Defense (OSD), believe that the Navy's 2005 estimate of DD(X)/CG(X) procurement costs is still too low. Although the Navy plans to eventually increase the combined DD(X)/CG(X) procurement rate to two ships per year, affordability considerations could keep the combined rate at one per year.[124]

If improvements to Aegis radar capabilities are not sufficient to achieve the Navy's desired radar capability for countering modernized PLA TBMs, then DD(X)/CG(X) radar capabilities could become important to achieving this desired capability. If so, then a potential additional issue raised by PLA TBM modernization efforts is whether a combined DD(X)/CG(X) procurement rate of one ship per year would be sufficient to achieve this desired capability in a timely manner. If the Navy in the future maintains a total of 11 carrier strike groups (CSGs), and if DD(X)/CG(X) procurement proceeds at a rate of one ship per year, the Navy would not have 11 DD(X)s and CG(X)s — one DD(X) or CG(X) for each of 11 CSGs — until 2022. If CG(X)s are considered preferable to DD(X)s for missile defense operations, then the earliest the Navy could have 11 CG(X)s would be 2026.

DD(X)/CG(X) radar technologies could be introduced into the fleet more quickly by procuring DD(X)s and CG(X)s at a higher rate, such as two ships per year.

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[124] For more on the DD(X) and CG(X), see CRS Report RS20159, *Navy DD(X) and CG(X) Programs: Background and Issues for Congress*, by Ronald O'Rourke; and CRS Report RL32109, *Navy DD(X), CG(X), and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke.

A DD(X)/CG(X) procurement rate of two ships per year, however, could make it more difficult for the Navy to procure other kinds of ships or meet other funding needs.

A potential alternative strategy would be to design a reduced-cost alternative to the DD(X)/CG(X) that preserves DD(X)/CG(X) radar capabilities while reducing other DD(X)/CG(X) payload elements. Such a ship could more easily be procured at a rate of two ships per year within available resources. The option of a reduced-cost alternative to the DD(X)/CG(X) that preserves certain DD(X)/CG(X) capabilities while reducing others is discussed in more detail in another CRS report.[125]

Block II/Block IIA Version of SM-3 Interceptor. *If feasible, should the effort to develop the Block II/Block IIA version of the Standard Missile 3 (SM-3) interceptor missile be accelerated?*

The Navy plans to use the Standard Missile 3 (SM-3) interceptor for intercepting TBMs during the midcourse portion of their flight. As part of the Aegis ballistic missile defense block upgrade strategy, the United States and Japan are cooperating in developing technologies for a more-capable version of the SM-3 missile called the SM-3 Block II/Block IIA. In contrast to the current version of the SM-3, which has a 21-inch-diameter booster stage but is 13.5 inches in diameter along the remainder of its length, the Block II/Block IIA version would have a 21-inch diameter along its entire length. The increase in diameter to a uniform 21 inches would give the missile a burnout velocity (a maximum velocity, reached at the time the propulsion stack burns out) that is 45% to 60% greater than that of the current 13.5-inch version of the SM-3.[126] The Block IIA version would also include a improved kinetic warhead.[127] The Missile Defense Agency (MDA) states that the Block II/Block IIA version of the missile could "engage many [ballistic missile] targets that would outpace, fly over, or be beyond the engagement range" of earlier versions of the SM-3, and that

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[125] See the "Options For Congress" section of CRS Report RL32109, op cit.

[126] The 13.5-inch version has a reported burnout velocity of 3.0 to 3.5 kilometers per second (kps). See, for example, J. D. Marshall, *The Future Of Aegis Ballistic Missile Defense*, point paper dated October 15, 2004, available at [http://www.marshall.org/pdf/materials/259.pdf]; "STANDARD Missile-3 Destroyers a Ballistic Missile Target in Test of Sea-based Missile Defense System," Raytheon news release circa January 26, 2002, available on the Internet at [http://www.prnewswire.com/cgi-bin/micro_stories.pl?ACCT=683194&TICK=RTN4&STORY=/www/story/01-26-2002/0001655926&EDATE=Jan+26,+2002]; and Hans Mark, "A White Paper on the Defense Against Ballistic Missiles," *The Bridge*, summer 2001, pp. 17-26, available on the Internet at [http://www.nae.edu/nae/bridgecom.nsf/weblinks/NAEW-63BM86/$FILE/BrSum01.pdf?OpenElement]. See also the section on "Sea-Based Midcourse" in CRS Report RL31111, *Missile Defense: The Current Debate*, coordinated by Steven A. Hildreth.

[127] Source for information on SM-3: Missile Defense Agency, "Aegis Ballistic Missile Defense SM-3 Block IIA (21-Inch) Missile Plan (U), August 2005," a 9-page point paper provided by MDA to CRS, August 24, 2005.

> the net result, when coupled with enhanced discrimination capability, is more types and ranges of engageable [ballistic missile] targets; with greater probability of kill, and a large increase in defenses "footprint" or geography predicted.... The SM-3 Blk II/IIA missile with it[s] full 21-inch propulsion stack provides the necessary fly out acceleration to engage IRBM and certain ICBM threats.[128]

Regarding the status of the program, MDA states that "The Block II/IIA development plan is undergoing refinement. MDA plans to proceed with the development of the SM-3 Blk II/IIA missile variant if an agreeable cost share with Japan can be reached.... [The currently envisaged development plan] may have to be tempered by budget realities for the agency."[129]

In March 2005, the estimated total development cost for the Block II/Block IIA missile was reportedly $1.4 billion.[130] In September 2005, it was reported that this estimate had more than doubled, to about $3 billion.[131] MDA had estimated that the missile could enter service in 2013 or 2014,[132] but this date reportedly has now slipped to 2015.[133]

In light of PLA TBM modernization efforts, a potential question is whether, if feasible, the effort to develop the Block II/Block IIA missile should be accelerated, and if so, whether this should be done even if this requires the United States to assume a greater share of the development cost.[134] A key factor in this issue could be assessments of potential PLA deployments of longer-ranged PLA TBMs.

Kinetic Energy Interceptor (KEI). *Should funding for development of the Kinetic Energy Interceptor (KEI) be increased?*

The Kinetic Energy Interceptor (KEI) is a proposed new ballistic missile interceptor that, if developed, would be used as a ground-based interceptor and perhaps subsequently as a sea-based interceptor. Compared to the SM-3, the KEI would be much larger (perhaps 40 inches in diameter and 36 feet in length) and would have a much higher burnout velocity. Basing the KEI on a ship would require

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[128] "Aegis Ballistic Missile Defense SM-3 Block IIA (21-Inch) Missile Plan (U), August 2005," op cit, pp. 3-4.

[129] Ibid., p. 3.

[130] Aarti Shah, "U.S. Navy Working With Japanese On Billion-Dollar Missile Upgrade," *Inside the Navy*, March 14, 2005.

[131] "Cost Of Joint Japan-U.S. Interceptor System Triples," Yomiuri Shimbun (Japan), September 25, 2005.

[132] "Aegis Ballistic Missile Defense SM-3 Block IIA (21-Inch) Missile Plan (U), August 2005," op cit, p. 7.

[133] "Cost Of Joint Japan-U.S. Interceptor System Triples," Yomiuri Shimbun (Japan), September 25, 2005.

[134] Japan reportedly has expressed a willingness to finance one-third to one-half the cost of developing the Block II/Block IIA missile. See Mari Yamaguchi, "Japan To Help Pay For Missile Defense," *NavyTimes.com*, December 15, 2005; "Missile Defense Share Put Near $1.2 Billion," *Washington Times*, December 16, 2005: 19.

the ship to have missile-launch tubes that are bigger than those currently installed on Navy cruisers, destroyers, and attack submarines. The Missile Defense Agency (MDA), which has been studying possibilities for basing the KEI at sea, plans to select a preferred platform in May 2006.[135] Because of its much higher burnout velocity, the KEI could be used to intercept longer-ranged ballistic missiles, including intercontinental ballistic missiles (ICBMs) during the boost and early ascent phases of their flights. Development funding for the KEI has been reduced in recent budgets, slowing the missile's development schedule. Under current plans, the missile could become available for Navy use in 2014-2015.[136]

Although the KEI is often discussed in connection with intercepting ICBMs, it might also be of value as a missile for intercepting TBMs, particularly longer-range TBMs, which are called Intermediate-Range Ballistic Missiles (IRBMs). If so, then in the context of this report, one potential question is whether the Navy should use the KEI as a complement to the SM-3 for countering PLA TBMs, and if so, whether development funding for the KEI should be increased so as to make the missile available for Navy use before 2014-2015.

Ships with Missile-Launch Tubes. *Should the planned number of Navy missile-launch tubes be increased, and if so, how might this be done?*

Missile-launch tubes on U.S. Navy surface combatants, which are installed in batteries called vertical launch systems (VLSs), are used for storing and firing various weapons, including Tomahawk cruise missiles, antisubmarine rockets, air defense missiles, and SM-3 ballistic missile defense interceptors. The potential need to counter hundreds of PLA TBMs raises a potential question of whether U.S. Navy forces involved in a conflict in the Taiwan Strait area would have enough missile launch tubes to store and fire required numbers of SM-3s while also meeting needs for storing adequate numbers of other types of weapons.

Options for increasing the planned number of missile-launch tubes in the fleet include reactivating VLS-equipped Spruance (DD-963) class destroyers (61 tubes per ship), building additional Arleigh Burke (DDG-51) class Aegis destroyers (96 tubes per ship), building additional DD(X)s (80 tubes per ship), building additional CG(X)s (more than 80 tubes per ship), or designing and procuring a new and perhaps low-cost missile-tube ship of some kind. Options for a new-design ship include, among other things,

- a large ship equipped with hundreds of missile-launch tubes,[137]

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[135] Marc Selinger, "MDA TO Pick Platform For Sea-Based KEI in May," *Aerospace Daily & Defense Report*," August 19, 2005: 2.

[136] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Major Weapon Programs*, GAO-05-301, March 2005, pp. 89-90. See also Thomas Duffy, "Northrop, MDA Working On KEI Changes Spurred By $800 Million Cut," *Inside Missile Defense*, March 30, 2005: p. 1.

[137] Such a ship might be similar in some respects to the arsenal ship concept that the Navy pursued in 1996-1997. For more on the arsenal ship, see archived CRS Report 97-455, *Navy/DARPA Arsenal Ship Program: Issues and Options for Congress*; and archived CRS

- an intermediate size ship with several dozen tubes,
- a small and possibly fast ship equipped with a few dozen tubes, and
- a submarine equipped with perhaps several dozen tubes.

Air Warfare.

Mix of F/A-18E/Fs and F-35 Joint Strike Fighters (JSFs). *Should the Navy's planned mix of carrier-based F/A-18E/F strike fighters and F-35 Joint Strike Fighters (JSFs) be changed to include more JSFs and fewer F/A-18E/Fs?*

The Department of the Navy, which includes the Navy and the Marine Corps, currently plans to procure a total of 462 F/A-18E/F Super Hornet strike fighters and a total of 680 F-35 Joint Strike Fighters (JSFs). The F/A-18E/Fs would be operated by the Navy, and the JSFs would be operated by both services. The division of JSFs between the Navy and Marine Corps is under review, but earlier plans showed the Navy procuring a total of about 300 JSFs. Marine Corps JSFs could be operated from Navy carriers to perform Navy missions. The F/A-18E/F incorporates a few stealth features and is believed to be very capable in air-to-air combat. Compared to the F/A-18E/F, the JSF is much more stealthy and is believed to be more capable in air-to-air combat.

The growing number of fourth-generation fighters and strike-fighters in the PLA Air Force and the PLA Naval Air Force, and the growing number of modern PLA SAM systems, raises a potential question of whether the Navy should change its planned mix of carrier-based strike fighters to include more Navy JSFs and fewer F/A-18E/Fs. Such a change would produce a force with a better ability to avoid PLA SAM systems and more total air-to-air combat capability than the currently planned force.

The Department of the Navy's planned mix of F/A-18E/Fs and JSFs can be compared to the Air Force's strike fighter procurement plans. The Air Force plans to replace its current force of F-15 and F-16 fighters with a mix of 179 F/A-22 Raptor strike fighters and 1,763 JSFs. The F-22 is more stealthy and capable in air-to-air combat than the JSF. The Navy does not have an equivalent to the F-22. The Air Force argues that a mix of F/A-22s and JSFs will be needed in the future in part to counter fourth-generation fighters and strike fighters operated by other countries, including China. Supporters of the F/A-22 argue that the challenge posed by fourth-generation fighters in combination with modern integrated air defenses, is a key

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Report 97-1044, *Navy/DARPA Maritime Fire Support Demonstrator (Arsenal Ship) Program: Issues Arising From Its Termination*, both by Ronald O'Rourke. Both reports are out of print and are available directly from the author.

reason for procuring 381 or more F/A-22s, rather than 179.[138] Potential oversight questions include the following:

- If the Air Force is correct in its belief that a combination of F/A-22s and JSFs will be needed in part to counter fourth-generation fighters and modern SAM systems operated by other countries, including China, would the Department of the Navy's planned mix of JSFs and F/A-18E/Fs be sufficient to counter a PLA force of fighters and strike fighters that includes fourth-generation designs?

- If PLA attacks on U.S. air bases in the Western Pacific reduce the number of Air Force F/A-22s and JSFs that can participate in a conflict in the Taiwan Strait area, would the Department of the Navy's planned mix of F/A-18E/Fs and JSFs have sufficient air-to-air combat capability to counter the PLA's force of fighters and strike fighters?

Long-Range Air-To-Air Missile (Phoenix Successor). *Should the Navy acquire a long-range air-to-air missile analogous to the now-retired Phoenix missile?*

During the Cold War, when the U.S. Navy prepared to confront a Soviet sea-denial force that included land-based aircraft armed with long-range ASCMs, Navy carrier air wings included F-14 Tomcat fighters armed with Phoenix long-range (60 nautical miles to 110 nautical miles) air-to-air missiles. A key purpose of the F-14/Phoenix combination was to enable the Navy to shoot down approaching Soviet land-based aircraft flying toward U.S. Navy forces before they got close enough to launch their multiple long-range ASCMs. The strategy of shooting down the aircraft before they could launch their ASCMs was viewed as preferable because the aircraft were larger and less numerous than the ASCMs. This strategy of "shooting the archer rather than its arrows" formed part of a long-range air-to-air combat effort that was referred to as the Outer Air Battle.

Following the end of the Cold War 1989-1991, the need for waging an Outer Air Battle receded. Procurement of new Phoenixes ended in FY1990, and a planned successor to the Phoenix called the Advanced Air-To-Air Missile (AAAM) was canceled. The Phoenix was removed from service at the end of FY2004, and the F-14 is currently being phased out of service. Without the Phoenix, Navy strike fighters, like Air Force strike fighters, rely on a combination of medium- and short-range air-to-air missiles with ranges of roughly 10 nautical miles to 40 nautical miles.

In light of a potential need to counter PLA land-based strike fighters and maritime bombers protected by long-range SAMs, one question is whether a new

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[138] For more on the F-22, JSF, and F/A-18E/F, see CRS Issue Brief IB92115, *Tactical Aircraft Modernization: Issues for Congress*; CRS Report RL31673, *F/A-22 Raptor*, by Christopher Bolkcom; CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program: Background, Status, and Issues*; and CRS Report RL30624, *Military Aircraft, the F/A-18E/F Super Hornet Program: Background and Issues for Congress*, all by Christopher Bolkcom.

program for acquiring a successor to the Phoenix should be initiated. The Air Force during the Cold War did not operate the Phoenix because it did not face a scenario equivalent to the Navy's scenario of shooting down a Soviet aircraft armed with multiple long-range ASCMs. In a conflict in the Taiwan Strait, however, the United States might benefit from having both Navy and Air Force strike fighters equipped with a long-range air-to-air missile for shooting down PLA strike fighters and maritime bombers equipped with ASCMs. If so, then the cost of developing a new long-range air-to-air missile could be amortized over a combined Navy-Air Force purchase of the missile.

A January 2006 press article states that the new radar on the Navy's F/A-18E/F strike fighters will extend the range of the Advanced Medium-Range Air-to-Air Missile (AMRAAM) — the medium-range air-to-air missile currently used by the Air Force and Navy — from about 40 nautical miles to about 100 nautical miles:

> New information has been revealed about the active electronically-scanned array (AESA) APG-79 radar of the F/A-18E/F Super Hornet and the EA-18G Growler [an electronic warfare variant of the F/A-18E/F]. Apparently it is the first [aircraft radar] to have a range exceeding that of the aircraft's AIM-120 AMRAAM missile, so as to take full advantage of the missile's range. Ultimately the missile will engage targets at a range of about 100 nautical miles, rather than the current 40 nautical miles or less.[139]

If this information is correct, the development of a new long-range air-to-air missile as a successor to the Phoenix would not be necessary, unless a capability to destroy enemy aircraft at ranges of more than 100 nautical miles were desired.

Anti-Air Warfare (AAW).

Surface Ship AAW Upgrades. *Are current Navy plans for upgrading surface ship anti-air warfare (AAW) capabilities adequate?*

The PLA's acquisition of advanced and highly capable ASCMs such as the SS-N-27 Sizzler and the SS-N-22 Sunburn raises the question of whether current plans for modernizing Navy surface ship AAW capabilities are adequate. The Government Accountability Office (GAO) in previous years has expressed concerns regarding the Navy's ability to counter ASCMs.[140] Potential areas for modernization include, among other things, the following:

- ship radars, such as the SPY-1 radar on Aegis ships or the radars now planned for the DD(X) destroyer and CG(X) cruiser;

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[139] Norman Friedman, "A New Role For Active Radar Arrays?" *U.S. Naval Institute Proceedings*, January 2006: 91.

[140] General Accounting Office, *Navy Acquisitions[:] Improved Littoral War-Fighting Capabilities Needed*, GAO-01-493, May 2001; and General Accounting Office, *Defense Acquisitions[:] Comprehensive Strategy Needed to Improve Ship Cruise Missile Defense*, GAO/NSIAD-00-149, July 2000.

- AAW-related computer networking capabilities, such as the Cooperative Engagement Capability (CEC);[141]
- air defense missiles such as the Standard Missile,[142] the Evolved Sea Sparrow Missile (ESSM), and the Rolling Airframe Missile (RAM);
- close-in weapon systems, such as the Phalanx radar-directed gun;
- potential directed-energy weapons, such as solid state or free-electron lasers;
- decoys, such as the U.S-Australian Nulka active electronic decoy; and
- aerial targets for AAW tests and exercises, particularly targets for emulating supersonic ASCMs.[143]

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[141] For more on CEC, see CRS Report RS20557, *Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress*, by Ronald O'Rourke.

[142] The Navy is currently developing a new version of the Standard Missile called the SM-6 Extended Range Active Missile (ERAM) that will have a considerably longer range than the current SM-2 air defense missile. The SM-6 will also have an active seeker that will permit the missile to home in on the target on its own, without being illuminated by a ship-based radar, as is the case with the SM-2.

[143] An October 2005 report from the Defense Science Board (DSB) highlights "The dire need for several types of supersonic targets to represent existing anti-ship cruise missile threats." (Page 1) The report states:

> The Russians have produced and deployed a variety of supersonic, anti-ship cruise missiles. Some of these missiles are sea-skimming vehicles; others attack from high altitudes. At the time of the Task Force, the United States had zero capability to test its air defense systems such as AEGIS or Improved Sea Sparrow against supersonic targets, and the Task Force views this shortfall as the major deficiency in our overall aerial targets enterprise. Aggressive actions are needed to fix the problem. (Department of Defense, *Report of the Defense Science Board Task Force on Aerial Targets*. Washington, 2005. (October 2005, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics) pp. 2.)

A cover memorandum attached to the report from William P. Delaney and General Michael Williams, USMC (Ret.), the co-chairmen of the task force, states:

> The area of greatest concern to the Task Force was our gap in supersonic anti-ship cruise missiles for testing. The Russians have deployed at least three such cruise missiles that involve either sea-skimming flight profiles or a high-altitude profile involving a power dive to the target. At this time, we have no test vehicles for either flight profile.

See also John Liang, "DSB Highlights 'Dire' Need For Supersonic Cruise Missile Targets," *Inside the Navy*, November 14, 2005.

Littoral Combat Ship (LCS) AAW Capability. *Should the currently planned AAW capability of the Littoral Combat Ship (LCS) be increased?*

The Navy's planned Littoral Combat Ship (LCS) is to be armed with a 21-round Rolling Airframe Missile (RAM) launcher. The ship will also be equipped with an AAW decoy launcher.[144]

The PLA's acquisition of ASCMs that can be fired from aircraft, surface ships, and submarines raises the possibility that LCSs participating in a conflict in the Taiwan Strait area could come under attack by substantial numbers of ASCMs. Other Navy ships, such as Aegis cruisers and destroyers and, in the future, DD(X) destroyers and CG(X)s cruisers, could help defend LCSs against attacking ASCMs, but such ships might not always be in the best position to do this, particularly if ASCMs are launched at LCSs from undetected submarines or if the supporting U.S. Navy ships were busy performing other duties. If LCSs were damaged or sunk by ASCMs, the Navy's ability to counter enemy mines, submarines, and small boats — the LCS's three primary missions — would be reduced.

The possibility that the LCS's AAW system might be overwhelmed or exhausted by attacks from multiple ASCMs raises the question of whether the AAW capability planned for the LCS should be increased. Options for increasing the LCS's planned AAW capability include, among other things, adding another 21-round RAM launcher or supplementing the currently planned RAM launcher with a battery of Evolved Sea Sparrow (ESSM) missiles. In assessing such options, one factor to consider would be whether installing additional RAMs or ESSMs would require an increase in the planned size and cost of the LCS.

Antisubmarine Warfare (ASW).

Technologies. *Are current Navy efforts for improving antisubmarine warfare (ASW) technologies adequate?*

In addition to the issue discussed earlier of whether the Navy between now and 2010 will have enough ASW-capable platforms, another potential issue raised by the PLA submarine modernization effort is whether current Navy plans for improving antisubmarine warfare (ASW) technologies are adequate. The Navy states that it intends to introduce several new ASW technologies, including distributed sensors,

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The lack of targets for fully emulating supersonic ASCMs has been an issue since the early 1980s, when the Navy first deployed the Aegis AAW system. See CRS Report 84-180, *The Aegis Anti-Air Warfare System: Its Principal Components, Its Installation On The CG-47 And DDG-51 Class Ships, And Its Effectiveness*, by Ronald O'Rourke. (October 24, 1984) pp. 16-17. (This report is out of print and is available directly from the author.)

[144] For more on the LCS, see CRS Report RS21305, *Navy Littoral Combat Ship (LCS): Background and Issues for Congress*; and CRS Report RL32109, *Navy DD(X), CG(X), and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, both by Ronald O'Rourke.

unmanned vehicles, and technologies for networking ASW systems and platforms.[145] Admiral Michael Mullen, who became the Chief of Naval Operations (CNO) on July 22, 2005, has issued a guidance statement for the Navy for 2006 which says that Navy tasks for FY2006 will include, among other things, "Rapidly prototyp[ing] ASW technologies that will: hold at risk adversary submarines; substantially degrade adversary weapons effectiveness; and, compress the ASW detect-to-engage sequences. Sensor development is key."[146]

Training And Exercises. *Are current Navy plans for ASW training and exercises adequate?*

As mentioned earlier, success in an ASW operation is highly dependent on the proficiency of the people operating the ASW equipment, and ASW operational proficiency can take time to develop and can atrophy significantly if not regularly exercised. At various times since the end of the Cold War, some observers have expressed concerns about whether the Navy was placing adequate emphasis on maintaining ASW proficiency. The Navy in April 2004 established a new Fleet ASW Command, based in San Diego, to provide more focus to its ASW efforts, and since then has taken steps to enhance its ASW training and exercises:

- In April 2004, it was reported that carrier strike groups deploying from the U.S. West Coast would now stop in Hawaiian waters for three- to five-day ASW exercises before proceeding to the Western Pacific.[147]

- In March 2005, the Navy reached an agreement to lease a Swedish non-nuclear-powered submarine and its crew for a 12-month period. The submarine, which is equipped with an air-independent propulsion (AIP) system, arrived in San Diego in June 2005, where

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[145] For discussions of new ASW technologies, see Jennifer H. Svan, "Pacific Fleet Commander: Sub Threats Top Priority," *Pacific Stars and Stripes*, October 3, 2005; Jason ma, "Autonomous ASW Sensor Field Seen AS High-Risk Technical Hurdle," *Inside the Navy*, June 6, 2005; John R. Benedict, "The Unraveling And Revitalization Of U.S. Navy Antisubmarine Warfare," *Naval War College Review*, spring 2005, pp. 93-120, particularly pp. 109-110; Richard R. Burgess, "'Awfully Slow Warfare'," *Seapower*, April 2005, pp. 12-14; Jason Ma, "ASW Concept Of Operations Sees 'Sensor-Rich' Way Of Fighting Subs," *Inside the Navy*, February 7, 2005; Jason Ma, "Navy's Surface Warfare Chief Cites Progress In ASW Development," *Inside the Navy*, January 17, 2005; Otto Kreisher, "As Underwater Threat Re-Emerges, Navy Renews Emphasis On ASW," *Seapower*, October 2004, p. 15; and David Wood, "U.S. Navy Confronts Growing New Submarine Threat," *Newhouse.com*, September 10, 2004.

[146] M. G. Mullen, *CNO Guidance for 2006, Meeting the Challenge of a New Era*, Washington, 2005, p. 5.

[147] Christopher Munsey, "Fleet Anti-Sub Command Stands Up," *Navy Times*, April 19, 2004, p. 29.

it is being used to as a mock enemy submarine in Pacific Fleet ASW exercises.[148]

- The Navy in 2005 also reached an agreement with Colombia and Peru under which one non-nuclear-powered submarine from each country deployed to the Navy base at Mayport, FL, in April 2005 to support Atlantic Fleet ASW exercises for a period of two to five months. South American non-nuclear-powered submarines have been integrated into U.S. Navy exercises since 2002.[149]

- In October 2005, the commander of the Navy's Pacific Fleet said that, upon assuming command earlier in the year, he made ASW his highest priority and instituted a cyclic approach to ASW training that includes more frequent (quarterly) assessments, as well as training exercises with other navies.[150]

In light of these actions, the potential question is whether the Navy ASW training and exercises are now adequate, or whether they should be expanded further.

Active-Kill Torpedo Defense. *If feasible, should Navy plans for acquiring an active-kill torpedo defense system be accelerated?*

Navy surface ships and submarines are equipped with decoy systems for diverting enemy torpedoes away from their intended targets. Such decoys, however, might not always work, particularly against wake-homing torpedoes, which can be difficult to decoy. Under the Navy's surface ship torpedo defense (SSTD) development program, the U.S. Navy is developing an "active-kill" torpedo-defense capability for surface ships and also submarines that would use a small (6.75-inch diameter) anti-torpedo torpedo (ATT) to physically destroy incoming torpedoes. Current Navy plans call for the ATT to enter low-rate initial procurement (LRIP) in FY2009 and achieve initial operational capability on surface ships in FY2011.[151] In

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[148] Jose Higuera, "Sweden's Gotland Heads For A Year With US Navy," *Jane's Navy International*, July/August 2005; 8; S. C. Irwin, "Swedish Submarine Expected To Enhance Navy's Antisubmarine Warfare Primacy," *Navy Newsstand*, June 20, 2005; Gidget Fuentes, "Swedish Sub To Drill With U.S. Navy For A Year," *DefenseNews.com*, May 18, 2005; "U.S., Swedish Navies Sign Agreement To Bilaterally Train On State-Of-The-Art Sub," *Navy Newsstand*, March 23, 2005.

[149] Christopher Munsey, "Colombian, Peruvian Subs To Take Part In Exercise," *NavyTimes.com*, April 14, 2005; Mark O. Piggott, "South American Submarines Enhance U.S. Navy's Fleet Readiness," *Navy Newsstand*, April 14, 2005.

[150] Jennifer H. Svan, "Pacific Fleet Commander: Sub Threats Top Priority," *Pacific Stars and Stripes*, October 3, 2005.

[151] Sources: Department of the Navy, Department of the Navy Fiscal Year (FY) 2006/FY2007 Budget Estimates, Justification of Estimates, February 2005, Research, Development, Test & Evaluation, Navy Budget Activity 4, entry on Surface Ship Torpedo Defense program, PE (Program Element) 0603506N; and Pennsylvania State University Applied Research Laboratory web page on the torpedo defense programs office, available

(continued...)

light of the modern torpedoes, including wake-homing torpedoes, that are expected to be carried by modern PLA submarines, a potential question is whether, if feasible, the current ATT acquisition schedule should be accelerated. Hitting an approaching torpedo with another torpedo poses technical challenges which could affect the potential for accelerating the ATT development schedule.

Mine Warfare. *Are current Navy mine warfare plans adequate?*

The PLA's interest in modern mines may underscore the importance of the Navy's efforts to develop and acquire new mine countermeasures (MCM) systems, and perhaps raise a question regarding whether they should be expanded or accelerated. The Navy's MCM capabilities have been a matter of concern among members of the congressional defense committees for several years.

Conversely, the PLA Navy's own reported vulnerability to mines (see section on PLA Navy limitations and weaknesses) can raise a question regarding the less-frequently-discussed topic of the U.S. Navy's offensive mine warfare capability. To what degree can minelaying complicate PLA plans for winning a conflict, particularly a short-duration conflict, in the Taiwan Strait area? Do U.S. Navy plans include sufficient mines and minelaying platforms to fully exploit the PLA Navy's vulnerability to mines? The Navy has various mines either in service or under development,[152] and is exploring the option of starting development of an additional new mine called the 2010 Mine.[153]

Computer Network Security. *Are Navy efforts to ensure computer network security adequate?*

The PLA's published interest in IW/IO, and concerns that recent attacks on U.S. computer networks have in some cases originated in China, underscore the importance of U.S. military computer network security. The Navy in July 2002 established the Naval Network Warfare Command in part to prevent and respond to attacks on Navy computer networks.[154] Another CRS report discusses computer network security at length.[155]

EMP Hardening. *Are Navy efforts to harden its systems against electromagnetic pulse (EMP) adequate?*

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[151] (...continued)
on the Internet at [http://www.arl.psu.edu/capabilities/td.html].

[152] Current information on Navy mines and mine development programs is available on the Internet at [http://www.exwar.org/Htm/4000.htm].

[153] Andrew Koch, "USN May Launch Offensive Naval Mining Mission," *Jane's Defence Weekly*, December 1, 2004, p. 10.

[154] Harold Kennedy, "Navy Command Engages In Info Warfare Campaign," *National Defense*, November 2003. See also Frank Tiboni, "DOD's 'Manhattan Project'," *Federal Computer Week*, August 29, 2005.

[155] CRS Report RL32114, *Computer Attack and Cyberterrorism: Vulnerabilities and Policy Issues for Congress*, by Clay Wilson.

The possibility that the PLA might use nuclear weapons or high-power microwave (HPM) weapons to generate electromagnetic pulse (EMP) effects against the electronic systems on U.S. Navy ships and aircraft raises a potential question regarding the adequacy of the Navy's efforts to harden its systems against EMP effects. A 2004 commission studying the EMP issue expressed concerns about the potential vulnerability of U.S. tactical forces to EMP.[156]

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[156] *2004 EMP commission report*. The report of the commission stated on page 1 that "The high-altitude nuclear weapon-generated electromagnetic pulse (EMP) is one of a small number of threats that has the potential to hold our society seriously at risk and might result in defeat of our military forces." The report stated later that

> The end of the Cold War relaxed the discipline for achieving EMP survivability within the Department of Defense, and gave rise to the perception that an erosion of EMP survivability of military forces was an acceptable risk. EMP simulation and test facilities have been mothballed or dismantled, and research concerning EMP phenomena, hardening design, testing, and maintenance has been substantially decreased. However, the emerging threat environment, characterized by a wide spectrum of actors that include near-peers, established nuclear powers, rogue nations, sub-national groups, and terrorist organizations that either now have access to nuclear weapons and ballistic missiles or may have such access over the next 15 years have combined to place the risk of EMP attack and adverse consequences on the US to a level that is not acceptable.
>
> Current policy is to continue to provide EMP protection to strategic [i.e., long-range nuclear] forces and their controls; however, the end of the Cold War has relaxed the discipline for achieving and maintaining that capability within these forces....
>
> The situation for general-purpose forces (GPF) is more complex.... Our increasing dependence on advanced electronics systems results in the potential for an increased EMP vulnerability of our technologically advanced forces, and if unaddressed makes EMP employment by an adversary an attractive asymmetric option.
>
> The United States must not permit an EMP attack to defeat its capability to prevail. The Commission believes it is not practical to protect all of the tactical forces of the US and its coalition partners from EMP in a regional conflict. A strategy of replacement and reinforcement will be necessary. However, there is a set of critical capabilities that is essential to tactical regional conflicts that must be available to these reinforcements. This set includes satellite navigation systems, satellite and airborne intelligence and targeting systems, an adequate communications infrastructure, and missile defense.
>
> The current capability to field a tactical force for regional conflict is inadequate in light of this requirement. Even though it has been US policy to create EMP-hardened tactical systems, the strategy for achieving this has been to use the DoD acquisition process. This has provided many equipment components that meet criteria for durability in an EMP environment, but this does not result in confidence that fielded forces, as a system, can reliably withstand EMP attack. Adherence to the equipment acquisition policy also has

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The commission's report was received at a July 22, 2004, hearing before the House Armed Services Committee. At the hearing, Representative Steve Israel asked about the role of EMP in exercises simulating operations in the Taiwan Strait:

> **Representative Steve Israel:** [Representative Roscoe] Bartlett and I just attended an NDU [National Defense University] tabletop [exercise] with respect to the Straits of the Taiwan just last week. To your knowledge, has there been any tabletop exercise, has there been any simulation, any war-game that anticipates an EMP attack, and, if there has not been, do you believe that that would, in fact, be a useful exercise for NDU, the Pentagon or any other relevant entity? Dr. Graham, do you want to answer that?
>
> **Dr. William R. Graham (Commission Chairman):** Thank you. Let me poll the commission and see if they have any experience with that. General Lawson?
>
> **General Richard L. Lawson, USAF (Ret.) (Commissioner):** No, sir.
>
> **Graham:** Dr. Wood?
>
> **Dr. Lowell L. Wood, Jr. (Commissioner):** I don't believe there's been any formal exercise, certainly not to my knowledge. There's been extensive discussion of what the impact of Chinese EMP laydowns would be, not on Taiwan, which is, after all, considered by China to be part of its own territory, but on U.S. forces in the region which might be involved in the active defense of Taiwan. In particular, the consequences the EMP laydown on U.S. carrier task forces has been explored, and while, it's not appropriate to discuss the details in an open session like this, the assessed consequences of such an attack, a single-explosion attack, are very somber.
>
> Since that is a circumstance in which the target might be considered a pure military one in which the loss of life might be relatively small, but the loss of military capability might be absolutely staggering, it poses a very attractive option, at least for consideration on the part of the Chinese military.
>
> I would also remark that Chinese nuclear explosive workers at their very cloistered research center in northwestern China very recently published an authoritative digest and technical commentary on EMP in English, in a Chinese publication. It is very difficult to understand what the purpose of publishing a lengthy, authoritative article in English in a Chinese publication would be, if it was not to convey a very pointed message. This came not from military workers. It came from the people who would be fielding the weapon that would conduct the attack.
>
> **Graham:** Dr. Pry on our staff has made a survey of foreign writings on EMP, and he noted that while U.S. exercises have not to our knowledge played that scenario, Chinese military writings have discussed that scenario. So it's

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[156] (...continued)
been spotty, and the huge challenge of organizing and fielding an EMP-durable tactical force has been a disincentive to applying the rigor and discipline needed to do so. (Pages 47-48.)

certainly something they have thought of and it is within their mind. I have observed generally over the last 40 years that there's a tendency in the U.S. military not to introduce nuclear weapons in general and EMP in particular into exercise scenarios or game scenarios because it tends to end the game, and that's not a good sign. I think it would be a very interesting subject for the NDU group to take up and see and force them not to end the game. Time will not stop if such an event happens. Let them understand what the consequences will be.[157]

Later in the hearing, Representative Roscoe Bartlett returned to the topic of the potential effects of EMP on Navy ships:

Representative Bartlett: If China were to detonate a weapon high over our carrier task force, can we note in this [open] session what would the effects on the carrier task force be?

Graham: Mr. Bartlett, several years ago, the Navy dismantled the one simulator it had for exposing ships directly [to EMP]. It was the Empress simulator located in the Chesapeake Bay. So I don't believe any direct experimental work has been done for quite some time.

However, the general character of modern naval forces follows the other trends we've described, which is an increasing dependence upon sophisticated electronics for its functionality, and, therefore, I believe there's substantial reason to be concerned.

[Would] Any other commissioners [care to comment]?

Representative Bartlett: Dr. Wood?

Wood: In open session, sir, I don't believe it's appropriate to go much further than the comment that I made to [Representative] Israel that the assessments that are made of such attacks and their impacts are very somber.

The Navy generally believes — that portion of the Navy that's at all cognizant of these matters — that because they operate in an extremely radar-intensive environment, [since] they have a great deal of electromagnetic gear on board, some of which radiates pulses — radar pulses, for instance — because they can operate in that type of environment, that they surely must be EMP robust. These free-floating beliefs on the part of some Navy officers are not — repeat not — well grounded technically.[158]

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[157] Source: Transcript of hearing.

[158] Ibid.

Appendix A: Additional Details on China's Naval Modernization Efforts[159]

This appendix presents additional details and commentary on several of the elements of China's military modernization discussed in the Background section of this report.

Theater-Range Ballistic Missiles (TBMs). Regarding the potential for using TBMs against moving U.S. Navy ships at sea, DOD states that "China is exploring the use of ballistic missiles for anti-access/sea-denial missions."[160] ONI states that "One of the newest innovations in TBM weapons developments involves the use of ballistic missiles to target ships at sea. This is assessed as being very difficult because it involves much more than just a missile."[161] ONI continues:

> The use of ballistic missiles against ships at sea has been discussed for years. Chinese writings state China intends to develop the capability to attack ships, including carrier strike groups, in the waters around Taiwan using conventional theater ballistic missiles (TBMs) as part of a combined-arms campaign. The current conventional TBM force in China consists of CSS-6 and CSS-7 short-range ballistic missiles (SRBMs) deployed in large numbers. The current TBM force would be modified by changing some of the current missiles' ballistic reentry vehicles (RVs) to maneuvering reentry vehicles (MaRVs) with radar or IR seekers to provide the accuracy needed to attack ships at sea. The TBMs with MaRVs would have good defense penetration capabilities because of their high reentry speed and maneuverability. Their lethality could be increased, especially with terminally guided submunitions.
>
> In order to attack a ship or a carrier battle group with TBMs, the target must be tracked, and its position, direction, and speed determined. This information would be relayed in near real time to the missile launchers. China may be planning ultimately to use over-the-horizon (OTH) radar, satellites, and unmanned aerial vehicles (UAVs) to monitor the target's position. Reconnaissance assets would be used to detect the ship or carrier strike group before it entered into the range of Chinese TBMs, facilitating early preparation for the engagement, and refining the target's position. Target information would be relayed through communication satellites or other channels to a command center, and then to the missile launchers. TBMs with MaRVs would then be launched at the target's projected position. The missiles would fly their

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[159] Unless otherwise indicated, shipbuilding program information in this section is taken from *Jane's Fighting Ships 2005-2006*. 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.

[160] *2005 DOD CMP*, p. 4. Page 33 similarly states that China is "researching the possibility of using ballistic missiles and special operations forces to strike ships or their ashore support infrastructure."

[161] *2004 ONI WMC*, p. 21. On Page 3 (Overview), ONI notes, without reference to any specific country, that "antiship ballistic missiles could be fired at our ships at sea."

preplanned trajectories until onboard seekers could acquire the ship and guide the missiles to impact.[162]

Another observer states:

The PLA's historic penchant for secrecy and surprise, when combined with known programs to develop highly advanced technologies that will lead to new and advanced weapons, leads to the conclusion that the PLA is seeking [to] field new weapon systems that could shock an adversary and accelerate their defeat. In the mid-1990s former leader Jiang Zemin re-popularized an ancient Chinese term for such weapons, "Shashaojian," translated most frequently as "Assassin's Mace," or "silver bullet" weapons.

One potential Shashoujian is identified by the [DOD's 2005 report on China military power]: a maneuvering ballistic missile design to target U.S. naval forces. In 1996 a Chinese technician revealed that a "terminal guidance system" that would confer very high accuracy was being developed for the DF-21 [intercontinental ballistic missile, or ICBM]. Such a system could employ a radar similar to the defunct U.S. Pershing-2 MRBM or could employ off-board sensors with rapid data-links to the missile tied to satellite-navigation systems. Nevertheless, should such missiles be realized they will pose a considerable threat as the U.S. Navy is not yet ready to deploy adequate missile defenses.[163]

A separate observer states:

Land-based conventional tipped ballistic missiles with maneuverable (MarV) warheads that can hit ships at sea.... would be a Chinese "assassin's mace" sort of capability — something impossible to deal with today, and very difficult under any circumstances if one is forced to defend by shooting down ballistic missiles. The capability is dependent on Beijing's ability to put together the appropriate space-based surveillance, command, and targeting architecture necessary to make this work.[164]

One more observer states:

There is yet another exceedingly important chapter being written in the [PLA] ballistic-missile saga. China is trying to move rapidly in developing ballistic missiles that could hit ships at sea at MRBM [medium-range ballistic missile] ranges — in other words, to threaten carriers beyond the range at which they could engage Chinese forces or strike China. Among its other advantages for China, this method of attack avoids altogether the daunting prospect of having to cope with the U.S. Navy submarine force — as anti-submarine warfare is a big Chinese weakness. Along with these efforts to develop ballistic missiles

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[162] *2004 ONI WMC*, p. 22. Page 20 states: "Maneuvering reentry vehicles serve two purposes: one to provide an unpredictable target to complicate missile defense efforts and the other, potentially, to adjust missile flight path to achieve greater accuracy."

[163] *Fisher 7/27/05 testimony*, p. 6.

[164] Presentation entitled "Beijing Eye View of Strategic Landscale" by Mike McDevitt at a June 20, 2005, conference on the future of the U.S. Navy held in Washington, DC, by the American Enterprise Institute. Quote taken from McDevitt's notes for the presentation, which he provided to CRS.

to hit ships, they are, of course, working diligently to perfect the means to locate and target our carrier strike groups (CSGs). In that regard, an imperfect or rudimentary (fishing boats with satellite phones) means of location and targeting might be employed even earlier than the delay of several more years likely needed to perfect more reliable and consistent targeting of ships. Chinese missile specialists are writing openly and convincingly of MaRV'd ballistic missiles (missiles with maneuverable reentry vehicles) that maneuver both to defeat defenses and to follow the commands of seekers that spot the target ships. There seems little doubt that our naval forces will face this threat long before the Taiwan issue is resolved.[165]

Land-Attack Cruise Missile (LACMs). Regarding LACMs, DOD states:

China is developing LACMs to achieve greater precision than historically available from ballistic missiles for hard target strikes, and increased standoff. A first- and second-generation LACM remain under development. There are no technological bars to placing on these systems a nuclear payload, once developed.[166]

ONI states:

Land-attack cruise missiles (LACMs) are available for sale from many countries, and are marketed at arms shows around the world. Land-attack cruise missiles are becoming a significant adjunct to theater ballistic missiles in strike and deterrent roles. The number of countries manufacturing and purchasing LACMs continues to grow. Some of the systems in development are derivatives of antiship missiles, and some are dedicated designs, and a few weaponized UAVs [unmanned aerial vehicles] complete the inventory....

Israel, China, Germany, and South Africa are among the countries with LACM development programs.[167]

Another observer states:

Since the 1970s the PLA has placed a high priority on developing an indigenous strategic land attack cruise missile (LACM). This effort has been aided by the PLA's success in obtaining advanced cruise missile technology from Russia, Israel, the Ukraine and the United States. In early June an Internet-source photo appeared of anew Chinese cruise missile with unmistakable LACM characteristics. This would tend to support revelation from Taiwan earlier this year that by 2006 the PLA will deploy 200 new land-based LACMs. With their very high accuracy such cruise missiles allow strategic targets to be destroyed with non-nuclear warheads.[168]

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[165] *McVadon 9/15/05 testimony*, pp. 4-5.

[166] *2005 DOD CMP*, p. 29.

[167] *2004 ONI WMC*, pp. 25, 26

[168] *Fisher 7/27/05 testimony*, p. 9. Comments about LACMs also appear on pp. 3, 4, 5, and 11.

Anti-Ship Cruise Missiles (ASCMs). Regarding ASCMs, DOD states:

> The PLA Navy and Naval Air Force have or are acquiring nearly a dozen varieties of ASCMs, from the 1950s-era CSS-N-2/STYX to the modern Russian-made SS-N-22/SUNBURN and SS-N-27/SIZZLER. The pace of indigenous ASCM research, development, and production — and of foreign procurement — has accelerated over the past decade. Objectives for current and future ASCMs include improving closure speed (e.g., ramjet propulsion, such as with the SS-N-22), standoff distance (e.g., longer-range assets, such as the C-802), and stealthier launch platforms (e.g., submarines). SS-N-22 missiles may be fitted on smaller platforms in the future (e.g., the Russian Molniya patrol boat, which originated as a joint effort with China, or on the new stealth fast attack patrol boat).[169]

Regarding the SS-N-27s expected to be carried by the eight additional Kilo-class submarines China has ordered, ONI states:

> Russia continues to develop supersonic ASCMs. The most interesting is the 3M-54E design which has a cruise vehicle that ejects a rocket-propelled terminal sprint vehicle approximately 10 nautical miles from its target. The sprint vehicle accelerates to speeds as high as Mach 3 and has the potential to perform very high-g defensive maneuvers.[170]

Another observer states that "the very dangerous and lethal SS-N-27Bs [are] said by experts to be part of the best family of ASCMs in the world...."[171]

Land-Based Surface-to-Air Missiles (SAMs). Regarding SAM systems, DOD states:

> In August 2004, China received the final shipment from Russia of four S-300PMU-1/SA-20 surface-to-air missile (SAM) battalions. China has also agreed to purchase follow-on S-300PMU-2, the first battalion of which is expected to arrive in 2006. With an advertised intercept range of 200 km, the S-300PMU-2 provides increased lethality against tactical ballistic missiles and more effective electronic counter-counter measures.[172]

Another observer states that "before 2010," China could deploy more than 300 S-300 SAM systems to locations covering the Taiwan Strait.[173]

Land-Based Aircraft. Regarding land-based aircraft, DOD states:

> China has more than 700 aircraft within un-refueled operational range of Taiwan. Many of these are obsolescent or upgrades of older-generation aircraft. However, China's air forces continue to acquire advanced fighter aircraft from

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[169] *2005 DOD CMP*, p. 29.

[170] *2004 ONI WMC*, p. 23

[171] *McVadon 9/15/05 testimony*, p. 5.

[172] *2005 DOD CMP*, p. 4. See also p. 32.

[173] *Fisher 7/27/05 testimony*, p. 4. See also p. 10.

> Russia, including the Su-30MKK multirole and Su-30MK2 maritime strike aircraft. New acquisitions augment previous deliveries of Su-27 fighter aircraft. China is also producing its own version of the Su-27SK, the F-11, under a licensed co-production agreement with Moscow. Last year, Beijing sought to renegotiate its agreement and produce the multirole Su-27SMK for the remainder of the production run. These later generations of aircraft make up a growing percentage of the PLA Air Force inventory.
>
> China's indigenous 4th generation fighter, the F-10, completed development in 2004 and will begin fielding this year. Improvements to the FB-7 fighter program will enable this older aircraft to perform nighttime maritime strike operations. China has several programs underway to deploy new standoff escort jammers on bombers, transports, tactical aircraft, and unmanned aerial vehicle platforms.[174]

ONI states:

> China operates a force of 1950s vintage B-6D Badger dedicated naval strike bombers. Today, these aircraft are armed with the C601, an air-launched derivative of the Styx ASCM, but a program to arm them with the modern C802K is underway....
>
> China and Russia also are working on new tactical aircraft dedicated to the antiship mission. China's FB-7 Flounder has been in development since the 1970s; its production limited by engine difficulties. The C801K-armed FB-7 entered service with the Chinese Navy, and integration of the longer-range C802K on the FB-7 is underway.[175]

Another observer states that "By 2006, in my estimation, the PLA will have 400 Sukhoi [i.e., Su-27 and Su-30] fighters and fighter-bombers."[176]

Submarines. The paragraphs below discuss China's submarine modernization effort in more detail on a class-by-class basis.

Type 094 SSBN. China is building a new class of SSBN known as the Type 094 class. The first two Type 094 boats are expected to enter service in 2008 and 2010. The Type 094 design may be derived from the Shang-class (Type 093) SSN design discussed below. ONI states that China "wishes to develop a credible, survivable, sea-based deterrent with the capability to reach the United States" and that the Type 094 design "benefits from substantial Russian technical assistance."[177]

The Type 094 SSBN is expected to be armed with 12 CSS-NX-5 nuclear-armed submarine-launched ballistic missiles, also known as JL-2s. Observers believe these missiles will have a range of about 8,000 kilometers to 12,000 kilometers (about 4,320 nautical miles to 6,480 nautical miles). The latter figure could permit Type

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[174] *2005 DOD CMP*, p. 4. See also pp. 23-24, 25, 31-32.

[175] *2004 ONI WMC*, p. 27. *Fisher 7/27/05 testimony*, pp. 3-4, 9-10.

[176] Statement of Richard D. Fisher, Jr., as printed in *2/6/04 USCC hearing*, p. 72.

[177] *2004 ONI WMC*, p. 37.

094 SSBNs to attack targets in most of the continental United States while operating in protected bastions close to China.[178]

Shang (Type 093) SSN. China is building a new class of SSN, called the Shang (or Type 093) class. The first two Shang-class boats are expected to enter service in 2005, and construction of a third may have begun.

Observers believe the Shang-class SSNs will likely represent a substantial improvement over China's five older and reportedly fairly noisy Han (Type 091) class SSNs, which entered service between 1974 and 1990. The first Han-class boat reportedly was decommissioned in 2003, and observers expect the others will be decommissioned as Shang-class boats enter service.

The Shang class reportedly was designed in conjunction with Russian experts and is derived from the Soviet Victor III-class SSN design that was first deployed by the Soviet Union around 1978. The Victor III was the first in a series of quieter Soviet SSN designs that, by the mid-1980s, led to substantial concern among U.S. Navy officials that the Soviet Union was closing the U.S. lead in SSN technology and creating what Navy officials described an antisubmarine warfare (ASW) "crisis" for the U.S. Navy.[179]

ONI states that the Shang-class "is intended primarily for antisurface warfare at greater ranges from the Chinese coast than the current diesel force. China looks at SSNs as a primary weapon against aircraft carrier battle groups and their associated logistics support."[180] Observers expect the Shang-class boats to be armed with a modern ASCM and also with a LACM broadly similar to the U.S. Tomahawk land-attack cruise missile. One observer states:

> At first, [China's LACMs] will be launched by Second Artillery units, but soon after, they may also be used by PLA Air Force H-6 bombers and by the Navy's new Type 093 nuclear attack submarines. When used by the latter, the PLA will

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[178] A map published by ONI suggests that the JL-2 range is 4,300 nautical miles to 6,500 nautical miles. The caption for the map states "JL-2 range assessments extend to over 5,000 nautical miles, potentially putting all of the continental United States at risk." The map shows that range of 4,300 nautical miles would be sufficient to reach Alaska, Hawaii, and northwest Canada, that a range of 5,400 nautical miles would be sufficient to reach much or most of the continental United States, and that a range of 6,500 nautical miles would be sufficient to reach all of the continental United States with the possible exception of southern Florida. (*2004 ONI WMC*, p. 37.)

China also operates a single Xia (Type 092) class SSBN that entered service in 1987, and a single Golf (Type 031) non-nuclear-powered ballistic missile submarine (SSB) that entered service in the late 1960s. The Xia-class boat is armed with 12 CSS-N-3 (JL-1) SLBMs that have a range of roughly 1,200 nautical miles. The Golf-class boat is used as an SLBM test platform.

[179] See, for example, Ronald O'Rourke, "Maintaining the Edge in US ASW," *Navy International*, July/August 1988, pp. 348-354.

[180] *2005 ONI WMC*, p. 14.

> have its first platform capable of limited but politically useful non-nuclear power projection on a global scale....
>
> Once there is a build-up of Type 093s it should be expected that the PLA Navy may undertake patrols near the U.S. in order to draw U.S. SSNs back to defensive patrols.[181]

Kilo-class SS. China ordered four Kilo-class SSs from Russia in 1993; the ships entered service in 1995-1999. The first two were of the less capable (but still fairly capable) Project 877 variant, which Russia has exported to several countries; the other two were of the more capable Project 636 variant that Russia had previously reserved for its own use.

China in 2002 ordered eight additional Kilos from Russia, reportedly all of the Project 636 design. The ships reportedly are to be delivered in 2005 (six boats) and 2006 (two boats).[182] ONI states that the delivery of these eight boats "will provide the Chinese Navy with a significant qualitative increase in warfighting capability,"[183] while another observer states that the Kilo-class boats are "Among the most worrisome of China's foreign acquisitions...."[184]

The eight Kilos are expected to be armed with the Russian-made SS-N-27 Sizzler ASCM, also known as the Novator Alfa Klub 3M-54E — a highly dangerous ASCM that might as difficult to shoot down, or perhaps even more difficult to shoot down, than the SS-N-22 Sunburn ASCM on China's Russian-made Sovremenny-class destroyers (see discussion below on surface combatants). China's first four Kilos (or the two Project 636 boats, if not the two Project 877 boats) might also be refitted with the SS-N-27.

Yuan (Type 041) Class SS. China is building a new class of SS called the Yuan (or Type 041) class. The first Yuan-class boat, whose appearance reportedly came as a surprise to western observers,[185] was launched (i.e., put into the water for final construction) in 2004. Observers expect the first two Yuan-class boats to enter service in 2006.

Some observers believe the Yuan class may incorporate technology from Russia's most recent SS design, known as the Lada or Amur class, including possibly

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[181] *Fisher 7/27/05 testimony*, pp. 9, 11.

[182] As mentioned earlier, ONI states that all eight Kilo-class boats are scheduled for delivery by 2005 (*2004 ONI WMC*, p. 12), while some other sources project that the final boat or boats will be delivered by 2007.

[183] *2004 ONI WMC*, p. 12.

[184] *Tkacik 7/27/05 testimony*, p. 8. See also *Fisher 7/27/05 testimony*, pp. 11-12.

[185] *Jane's Fighting Ships 2005-2006*, for example, states: "It is fair to say that the intelligence community was caught completely unawares by the emergence of the Yuan class...." *Jane's Fighting Ships 2005-2006*, p. 30 (Executive Overview). See also Bill Gertz, "Chinese Produce New Type Of Sub," *Washington Times*, July 16, 2004: 1.

an air-independent propulsion (AIP) system.[186] One observer says the Yuan class strongly resembles both the Russian Amur 1650-class and French Agosta-class SS designs.[187] Another set of observers states:

> Evidence of China's advances in submarine design and construction emerged in July 2004, when Western media reports suddenly revealed China's production of the new Yuan class of conventional submarine. While much is still unknown about the Yuan, it appears to possess attributes of both the Song- and Kilo-class vessels, suggesting that China may have optimized features from each vessel class to meet its specific requirements for underwater warfare.[188]

Song (Type 039/039G) Class SS. China is also building a relatively new SS design called the Song (or Type 039/039G) class. The first Song-class boat entered service in 1999, and a total of 12 are expected to be in service by 2006. The first boat reportedly experienced problems, resulting in design changes that were incorporated into subsequent (Type 039G) boats. Some observers believe the Song-class design may have benefitted from PLA Navy experience with the Kilo class. One report states that one Song-class boat has been equipped with an AIP system.[189] One set of observers states:

> The design and production rates of China's new Song-class diesel submarine represent a significant advance over its predecessor, the Ming-class submarine. The Song class has a hydrodynamically sleek (teardrop) profile, possesses new cylindrical environmental sensors, and relies on German engines for propulsion. Most significantly, the Song is much quieter because it is fitted with an asymmetrical seven-blade skew propeller, and the Song uses anechoic rubber dampening tiles on the hull and shock absorbency for the engine to reduce its acoustic signature. The Song may also be able to launch cruise missiles when submerged, another design advance for China's conventional submarines. Seven Song-class vessels have reportedly been launched already, and additional ones have entered serial production at the Wuchang Shipyard in Wuhan. The rate of Song production has clearly increased in recent years.[190]

Older Ming (Type 035) and Romeo (Type 033) Class SSs. China in 2005 also had about 20 older Ming (Type 035) class SSs and about 21 even older Romeo (Type 033) class SSs (with an additional 10 in reserve status).

The first Ming-class boat entered service in 1971 and the 20th was launched in 2002. Production may have ended in favor of Song- and Yuan-class production. In

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[186] An AIP system, such as a fuel cell system or a closed-cycle diesel engine, extends the stationary or low-speed submerged endurance of a non-nuclear-powered submarine from a few days to perhaps two or three weeks. AIP technology does not extend the high-speed submerged endurance of a non-nuclear-powered submarine, which remains limited, due to battery capacity, to about 1 to 3 hours of high-speed operations.

[187] *Fisher 7/27/05 testimony*, p. 11.

[188] *2005 RAND report*, pp. 148-149.

[189] "CHINA — Submarine Force Moving Forward," *Submarine Review*, April 2005: 106.

[190] *2005 RAND report*, p. 148.

April 2003, a malfunction aboard one of the boats (hull number 361) killed its 70-man crew. Observers believe they were killed by carbon monoxide or chlorine poisoning. The boat was repaired and returned to service in 2004.

The Romeo-class boats entered service between the early 1960s and the late 1980s. A total of 84 were built. Of the 21 still in service, one is a modified boat that has been used as a cruise missile test ship. The 10 boats in reserve status may be of dubious operational condition. The total number of Romeos in service and reserve status has been declining over time.

If China decides that Ming- and Romeo-class 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), it may elect to keep some of these older submarines in service even as new submarines enter service.

Aircraft carriers. An August 2005 press report states:

> Chinese shipyard workers have been repairing a badly damaged ex-Russian aircraft carrier and have repainted it with the country's military markings, raising the question once again of whether China is pursuing longer-term plans to field its first carrier.
>
> In the latest developments, images show that workers at the Chinese Dalian Shipyard have repainted the ex-Russian Kuznetsov-class aircraft carrier Varyag with the markings and colour scheme of the People's Liberation Army (PLA) Navy (PLAN). Additional new photographs show that other work, the specifics of which could not be determined, appears to be continuing and that the condition of the vessel is being improved....
>
> Still, China's ultimate intentions for the Varyag remain unclear. One possibility is that Beijing intends to eventually have it enter into some level of service. A military strategist from a Chinese military university has commented publicly that the Varyag "would be China's first aircraft carrier."
>
> It is possible that the PLAN will modify the Varyag into a training aircraft carrier. A US intelligence official said the vessel could be made seaworthy again with enough time, effort and resources. However, US defence officials said that repairing the Varyag to become fully operational would be an extraordinarily large task. The carrier was about 70 per cent complete at the time of transfer and sensitive portions were destroyed, including damage to the core structure, before China was permitted to take possession. Given the difficulty and expense, it is questionable whether Beijing would pursue the effort only to use the Varyag as a training platform; such a move could, however, mark a transitional phase en route to a fully operational capability.
>
> Another possibility is that China does, indeed, plan to repair the vessel to become its first seagoing aircraft carrier or use knowledge gained from it for an indigenously built carrier programme. The US intelligence official said such an outcome "is certainly a possibility" if China is seeking a blue- water navy capable of protecting long-range national interests far from its shores such as sea lanes in the Strait of Malacca. If this strategy were to be followed, China would have to reinstate the structural integrity degraded before delivery and study the structural design of the carrier's deck. These two activities, along with the

> blueprints and the ship itself, could be used to design an indigenous carrier. Such a plan would very likely be a long-term project preceded by the development of smaller vessels such as amphibious landing ships.[191]

Another set of observers states that China's increased shipbuilding capacity

> has direct implications for China's ability to build an aircraft carrier. For the past decade, rumors have circulated that China is interested in buying or building a carrier. A Chinese military delegation is known to have considered buying Ukraine's Varyag, and the Spanish shipbuilder Bazan is reported to have submitted to China a design for a basic carrier.... China now has eight yards capable of VLCC and ULCC[192] construction, and it will add more such yards in the coming years. Many of these yards would be suitable for the construction of a large carrier. Another option for China would be to build a medium-sized carrier (30, — 50,000 tons) for launching and retrieving helicopters or vertical short take-off/landing (VSTOL) fixed-wing aircraft. Such a ship could be built from a relatively basic design based on LHD-type platforms (i.e., multipurpose amphibious assault ships) similar to the ones used by the United Kingdom, Japan, and Thailand. Such a vessel could also be completed at a number of modern yards in China, even ones without VLCC capacity — although with substantial naval shipbuilding experience.
>
> Although Chinese shipbuilders are quite capable of building the hull, other parts of China's defense industry would have to develop the equipment necessary to outfit an aircraft carrier with the necessary propulsion systems, navigational electronics, or weapon suites for self-defense or long-range operations. In addition, China lacks the capability to build either large-capacity aircraft-lift elevators or steam catapults for the movement and launching of aircraft; so a Chinese carrier would have to rely on a ski-jump design. Thus, a Chinese carrier would not resemble in any way, shape, or form a U.S. "big-deck" carrier, which serves as the operational hub for an entire carrier battle group. If China chooses to build an aircraft carrier, the need for more ships will become especially pressing in order to regularly protect and replenish the carrier. The PLAN currently lacks enough modern, multipurpose warships to adequately meet the needs of defending and replenishing a carrier. It is to this end that an expanding and improving shipbuilding infrastructure is a necessary condition for the development of modern, long-range naval capabilities.[193]

Surface Combatants. One observer states that by 2010, China's surface combatant force

> could exceed 31 destroyers and 50 frigates, backed up by 30 ocean-capable stealthy fast attack craft. Such a force could then be used in conjunction with submarines and attack aircraft to impose a naval blockade around Taiwan.

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[191] Yihong Chang and Andrew Koch, "Is China Building A Carrier?," *Jane's Defence Weekly*, August 17, 2005. See also Ian Storey and You Ji, "China's Aircraft Carrier Ambitions, Seeking Truth from Rumors," *Naval War College Review*, winter 2004, pp. 77-93.

[192] VLCCs (very large crude carriers) and ULCCs (ultra-large crude carriers) are the two largest kinds of commercial crude oil tankers.

[193] *2005 RAND report*, pp. 149-150.

> Surface ships could also defend the airspace around Taiwan from U.S. Naval forces, especially its P-3 anti-submarine warfare aircraft which would play a critical role in defeating a blockade.[194]

Another set of observers states that improvements in China's shipbuilding industry

> are also reflected in the improvements in Chinese warships commissioned in the late 1990s and in many of the new naval projects currently coming online. The newest vessels are more durable, are more capable of surviving damage, have longer ranges, are stealthier, and are capable of carrying a variety of modern weapon systems. China's serial production of a variety of new naval platforms in the past five years is notable in this regard. The current degree of simultaneous production of several new classes of naval platforms has not been seen in China for decades.[195]

Luhai (Type 051B) Destroyer. One set of observers states:

> The Luhai-class destroyer, which was launched in October 1997 and commissioned into the PLAN in late 1998, represented a significant design advance over China's second-generation Luhu-class destroyer. In terms of overall size, the Luhai is 20 percent larger. It has a widened hull beam to enhance stability, armament-carrying capacity, and crew living space. In particular, the Luhai's larger size permits four quad launchers for C801/C802 anti-ship missiles, which is double the number, deployed on the Luhu. The Luhai also uses a gas turbine engine, which is more powerful than the Luhu's diesel gas turbine system. In addition, the design of the Luhai's bridge and superstructure exhibits a number of stealthy characteristics (particularly in comparison to the Luhu's structure). These design features include a streamlined superstructure with inclined angles and two solid masts with fewer protruding electronic sensor arrays. The stepped superstructure may have been designed with the intention to equip the Luhai with vertical launch systems, possibly for SAMs for an enhanced area-defense capability. The absence of such a system on the Luhai suggests that that option was deferred for a time.[196]

Luyang I (Type 052 B) and II (Type 052C) Destroyers. One set of observers states that the Luyang I and II classes

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[194] *Fisher 7/27/05 testimony*, p. 12.

[195] *2005 RAND report*, p. 110. Similarly, the repot states on page 140 that

> The expansion and modernization of China's shipbuilding industry contributed to the PLAN's efforts to design and build better naval vessels.... These developments have enabled Chinese shipbuilders to build more-seaworthy and more reliable naval ships with better habitability, damage control facilities, engines, and electronics. In short, Chinese shipbuilders have become more efficient, better skilled, and more sophisticated in designing and building ships for the PLAN.

[196] *2005 RAND report*, pp. 144-145.

represent important advances in the shipbuilding industry's overall design and production techniques.... The latter have a similar design as the former, but they appear to be optimized for air-defense missions....

These four new destroyers represent an important evolution in shipbuilding design capabilities, production techniques, and management practices. The hulls are larger than the Luhai's, which increases their weapons capacity, versatility, and stability on the high seas. The designs of these vessels are even stealthier, with sloped sides and a superstructure with a reduced profile — attributes that, collectively, reduce the vessel's radar signature. Also, these hulls were built using modular shipbuilding, a technique increasingly widespread in China's most modern shipyards. Modular construction (as opposed to keel-up) allows for work to be done on different sections at the same time, increasing the efficiency and speed of the production process. One of the most significant aspects of the new destroyers is the fact that China constructed these four new destroyers at the same time and quite quickly as well, at least compared with past experiences. This serial production of an indigenously designed vessel is a first in the PRC's naval history and a testament to improved project management. The four new 052B- and 052C-class vessels have been built or have been under construction within the past four years. By comparison, in the entire decade of the 1990s China only built a second Luhu (1993) and one Luhai (1997) destroyer.

The 052C-class destroyer, in particular, possesses several important attributes. First, according to Goldstein and Murray, it uses a phased array or planar radar on the four corners of the bridges' vertical superstructure, which would be used with a SAM vertical launch system (VLS) for air-defense missiles — a second important innovation. Both of these attributes are a first for a Chinese combatant and help the PLAN resolve its long-standing weakness with air defense. In the past, Chinese combatants relied on short-range SAMs for air defense. A medium-range VLS SAM system would provide the Chinese navy with its first, real area-defense vessel, and a collection of such ships could allow the PLA Navy to operate surface action groups. If China is able to successfully reverse engineer Russian-purchased SAMs, then it may deploy them on the 052C destroyer. Some reports indicate that China may deploy its HQ-9 system (a Chinese version of a Russian SAM with a range of about 120 km) on the new destroyers. Such a system on the front of the new platform, combined with older Chinese SAMs in the stern, would give the Chinese their first fleet air-defense vessels.[197]

Regarding the radar to be carried by the Luyang II class, a January 2006 press article states: "The two Chinese Project 052C destroyers have fixed array radars that are often described as active arrays, though that cannot be certain."[198] Active radar arrays use a technology that is more modern and more capable in certain respects than the technology used in the SPY-1 radars on the U.S. Navy's Aegis ships.

Regarding the HQ-9 SAM believed to be carried by the Luyang II-class destroyers, ONI states:

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[197] *2005 RAND report*, pp. 146-147

[198] Norman Friedman, "A New Role For Active Radar Arrays?" *U.S. Naval Institute Proceedings*, January 2006: 91.

> The most challenging threat to aircraft and cruise missiles comes from high-performance, long-range [SAM] systems like the Russian SA-10/SA-20 family. The system combines very powerful three-dimensional radar and a high-performance missile with engagement ranges in excess of 100 nautical miles against a conventional target. The SA-10/SA-20 has been marketed widely and has enjoyed some success in the export market, but its high cost has limited its proliferation. Technology from the SA-10 is being incorporated into China's 50-nautical mile range HQ-9 SAM, which is intended for use on the new LUYANG destroyer. The HQ-9 will provide China's navy with its first true area air defense capability when the SAM becomes operational in the next few years.[199]

Jiangkai (Type 054) Frigates. One set of observers states that the Jiangkai-class design

> is larger and more modern than that of China's Jiangwei II — class frigates. Like China's new destroyers, the new frigate has a more streamlined design and has a larger displacement. These changes augment the new vessel's warfighting capabilities and its seaworthiness. Some sources note that the 054 frigate resembles the French Layfayette-class guided-missile frigate because of the minimalist design of the Type 054's superstructure. The design of the new frigate also offers greater options for outfitting the vessel with various weapon suites. Some estimates indicate that the new frigate will have a significantly enhanced set of weapon capabilities over the Jiangwei-class frigates, possibly including VLS capabilities.[200]

Amphibious Ships. The three new classes of amphibious ships and craft now under construction in China, all of which began construction in 2003, are as follows:

- **Yuting II-class helicopter-capable tank landing ships (LSTs).** Three of these ships entered service in 2003 and another six in 2004. Each ship can transport 10 tanks and 250 soldiers, and has a helicopter landing platform for two medium-sized helicopters. The ships were built at three shipyards, and additional units are expected.

- **Yunshu-class landing ships (LSMs).** Ten of these ships entered service in 2004. Each ship can transport 6 tanks or 12 trucks or 250 tons of supplies. The ships were built at four shipyards, and additional units are expected.

- **Yubei-class utility landing craft (LCUs).** Eight of these landing craft entered service in 2004. Each craft can transport 10 tanks and 150 soldiers. The ships were built at four shipyards, and additional units are expected.

DOD states:

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[199] *2004 ONI WMC*, p. 29.

[200] *2005 RAND report*, p. 147.

> The PLA recently increased amphibious ship production to address its lift deficiencies — although the intelligence community believes these increases will be inadequate to meet requirements — and is organizing its civilian merchant fleet and militia, which, given adequate notification, could augment the PLA's organic lift in amphibious operations.[201]

Another set of observers states that

> China's development and production of new classes of amphibious vessels [is] a testament to the SBI's [shipbuilding industry's] improved production capacity, as well as to advances in ship-design and project-management skills. In the past few years, China has designed a new class of landing ships/tanks (LSTs) and has built at least seven of them. This new follow-on to the Yuting-class vessels is enlarged and has a greater carrying capacity. With these new ships, China's inventory of LSTs has grown from 16 to 23. China also designed and built several new medium-landing ships (LSMs), which appear to be a follow-on to China's Yuedeng-class vessels. In addition, Goldstein and Murray note that the PLA Navy aspires to building a 12,300-ton amphibious transport dock (LDP) capable of transporting several helicopters and air-cushion landing crafts.[202]

Information Warfare/Information Operations (IW/IO). Regarding IW/IO capabilities, ONI states, without reference to any specific country:

> IO is the combination of computer network attack, electronic warfare, denial and deception (D&D), and psychological operations (PSYOP)....
>
> Outside attack on Navy networks can take different forms depending on the attacker's goals and sophistication. Navy networks have been targeted for denial of service attacks from the Internet. More sophisticated operations, perhaps conducted by foreign military or intelligence services, might include covertly mapping Navy networks, installing backdoors to facilitate future intrusions, stealing data, and leaving behind destructive code packages to be activated in time of conflict. Malicious codes like the Melissa virus have appeared in classified networks, demonstrating that an external attack on ostensibly protected networks could succeed. Attacks could selectively alter information in Navy databases and files, introducing errors into the system. When discovered or revealed, this corruption of trusted data could cause us to lose confidence in the integrity of the entire database.[203]

Nuclear Weapons. Regarding the potential use of nuclear weapons against U.S. Navy forces, one study states that

> there is some evidence the PLA considers nuclear weapons to be a useful element of an anti-access strategy. In addition to the nuclear-capable [ballistic] missiles... China has nuclear bombs and aircraft to carry them, and is reported to have nuclear mines for use at sea and nuclear anti-ship missiles. At the very least,

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[201] *2005 DOD CMP*, p. 31. See also *Fisher 7/27/05 testimony*, p. 13.

[202] *2005 RAND report*, pp. 147-148.

[203] *2004 ONI WMC*, p. 38.

> China would expect the presence of these weapons and the threat to use them to be a significant deterrent to American action.[204]

Regarding the possibility of China using a high-altitude nuclear detonation to create an EMP effect, DOD states:

> Some PLA theorists are aware of the electromagnetic effects of using a high-altitude nuclear burst to generate high-altitude electromagnetic pulse (HEMP), and might consider using HEMP as an unconventional attack, believing the United States and other nations would not interpret it as a use of force and as crossing the nuclear threshold. This capability would most likely be used as part of a larger campaign to intimidate, if not decapitate, the Taiwan leadership. HEMP causes a substantial change in the ionization of the upper atmosphere, including the ionosphere and magnetosphere. These effects likely would result in the degradation of important war fighting capabilities, such as key communication links, radar transmissions, and the full spectrum of electro-optic sensors. Additional effects could include severe disruptions to civil electric/power and transportation. These effects cannot easily be localized to Taiwan and would likely affect the mainland, Japan, the Philippines, and commercial shipping and air routes in the region.[205]

Whether China would agree with the above view that EMP effects could not easily be localized to Taiwan and surrounding waters is not clear. The effective radius of a high-altitude EMP burst is dependent to a strong degree on the altitude at which the warhead is exploded (the higher the altitude, the greater the radius).[206] China might therefore believe that it could detonate a nuclear warhead somewhere east of Taiwan at a relatively low altitude, so that the resulting EMP radius would be sufficient to affect systems in Taiwan and on surface ships in surrounding waters, but not great enough to reach systems on China's mainland.[207] Following the detonation,

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[204] *The Chinese Military, An Emerging Maritime Challenge*, Washington, Lexington Institute, 2004, pp. 13-14.

[205] *2005 DOD CMP*, p. 40.

[206] A report by the Office of Technology Assessment (a congressional support agency that was closed in 1995), states: "The size of the area that could be affected by EMP is primarily determined by the height of burst and is only very weakly dependent on the yield." (*MX Missile Basing*. Washington, Office of Technology Assessment, 1981. (September 1981) p. 297. The document is available on the Internet at [http://www.wws.princeton.edu/ota/ns20/year_f.html].

[207] CRS Report RL32544, op cit, states that "creating a HEMP [high-altitude EMP] effect over an area 250 miles in diameter [i.e., a radius of 125 miles], an example size for a battlefield, might only require a rocket with a modest altitude and payload capability that could loft a relatively small nuclear device."

One observer states that a detonation height of 200 kilometers (108 nautical miles) would produce an EMP effect out to a radius of about 1,600 kilometers (864 nautical miles), while a detonation height of 50 kilometers would produce an EMP effect out to a radius of about 800 kilometers (432 nautical miles). (Written Statement by Dr. Michael Bernardin, Provost for the Theoretical Institute for Thermonuclear and Nuclear Studies, Applied Theoretical and Computational Physics Division, Los Alamos National Laboratory, before the Military

(continued...)

China could attempt to confuse the issue in the public arena of whose nuclear warhead had detonated. Alternatively, China could claim that the missile launch was an accident, and that China command-detonated the warhead at altitude as a failsafe measure, to prevent it from detonating closer to the surface and destroying any nearby ships.[208]

High-Power Microwave (HPM) Weapons. Regarding radio-frequency weapons, ONI states:

> Radio-frequency weapons (RFW) could be used against military networks since they transmit high power radio/microwave energy to damage/disrupt electronic components. RFWs fall into two categories, beam and warhead. A beam weapon is a multiple use system that can repeatedly send directional RF energy at different targets. An RF warhead is a single-use explosive device that can be delivered to the target by multiple means, including missiles or artillery shells. RFWs can be assembled with little technical knowledge from commercial off-the-shelf components, such as surplus military radars.[209]

One observer states that, "at least one U.S. source indicates the PLA has developed" non-nuclear radio frequency warheads for ballistic missiles.[210] When asked at a hearing about the possibility of China using a nuclear weapon to generate an EMP effect against Taiwan and U.S. naval forces, this observer stated:

> What worries me more, Congressman, is non-nuclear electromagnetic pulse weapons. Non-nuclear explosive propelled radio frequency or EMP-like devices that could be used with far greater frequency and far more effect because they

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[207] (...continued)
Research and Development Subcommittee of the House Armed Services Committee, October 7, 1999.)

A map presented by another observer shows that a detonation height of 100 kilometers (54 nautical miles) would produce an EMP effect out to a radius of about 1,000 kilometers (540 nautical miles). (Statement of Dr. Gary Smith, Director, The Johns Hopkins University Applied Physics Laboratory, before Military Research and Development Subcommittee of the House Armed Services Committee, July 16, 1996.)

Another published map states that a detonation height of 30 miles would produce an EMP effect out to a radius of 480 miles. A source note attached to the map attributes it to the above-cited July 16, 1997 testimony of Gary Smith. (See page 3 of Jack Spencer, *America's Vulnerability To A Different Nuclear Threat: An Electromagnetic Pulse*. Washington, Heritage Foundation, 2000. 7 pp. (Backgrounder No. 1372, May 26, 2000) The document is available on the Internet at [http://www.heritage.org/Research/MissileDefense/bg1372.cfm]).

[208] Even if China does not have the capability to command the early detonation of a warhead on a ballistic missile in flight, it could claim afterward that it did.

[209] *2004 ONI WMC*, p. 39.

[210] *Fisher 7/27/05 testimony*, p. 6. A footnote at this point in Fisher's statement says this information was: "Disclosed to the author by a U.S. source in September 2004." See also page 9.

would not run the danger for China of prompting a possible nuclear response. Thereby it would be much more tempting to use and use effectively.

If you could combine a non-nuclear radio frequency weapon with a maneuvering ballistic missile of the type that the Pentagon report describes very briefly this year, that would constitute a real Assassin's Mace weapon. One that, in my opinion, we cannot defend ourselves against and would possibly effectively deny effective military — effective American military intervention in the event of — not just a Taiwan crisis, but other crises as well.[211]

[211] Spoken testimony of Richard D. Fisher, Jr., in transcript of *7/27/05 HASC hearing*, in response to a question from Representative Curt Weldon.