

CRS Report for Congress

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

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Prepared for Members and
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Summary

Concern has grown in Congress and elsewhere since the 1990s about China's military modernization. Several of the U.S. Navy's most expensive acquisition programs, as well as Navy initiatives for homeporting ships and for training sailors, are for developing or maintaining capabilities that could be useful or critical in countering improved Chinese maritime military capabilities in coming years. 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, naval mines, submarines, surface combatants, amphibious ships, 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 shipbuilding dependence on foreign suppliers.

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.

China's naval modernization raises potential issues for Congress concerning the role of China in Department of Defense and Navy planning; the size of the Navy; the Pacific Fleet's share of the Navy; forward homeporting in the Western Pacific; the number of aircraft carriers, submarines, and ASW platforms; Navy missile defense, air-warfare, AAW, ASW, and mine warfare programs; Navy computer network security; and EMP hardening. This report will be updated as events warrant.

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

Introduction

Issue for Congress

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.¹ Several of the U.S. Navy's most expensive acquisition programs, as well as Navy initiatives for homeporting ships and for training sailors, are for developing or maintaining capabilities that could be useful or critical in countering improved Chinese maritime military capabilities in coming years.

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, Sources, and Terminology

This report focuses on the implications that certain elements of China's military modernization may have for future required U.S. Navy capabilities.² Other CRS reports address separate issues relating to China and China's military.

¹ For some examples since 2005 of expressions of concern about China's military modernization, and of its potential implications for U.S. Navy requirements, see **Appendix A**.

² This CRS report does not discuss (1) elements of China's military modernization that may be less relevant to future required U.S. Navy capabilities; (2) the potential implications of China's military modernization for parts of the Department of Defense (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; and (3) 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.

This report is based on unclassified open-source information.

For convenience, this report uses the term China's naval modernization, even though some Chinese 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 Force.

Background

China's Naval Modernization³

This section summarizes certain elements of China's military modernization that may have implications for required U.S. Navy capabilities. See **Appendix B** for additional details and commentary on several of these modernization activities. In addition to the modernization efforts discussed here and in **Appendix B**, China's anti-satellite and cyberwarfare capabilities may have implications for required U.S. Navy capabilities.

Missiles.

Theater-Range Ballistic Missiles (TBMs). China is deploying large numbers of theater-range ballistic missiles (TBMs)⁴ capable of attacking targets in Taiwan or other regional locations. DOD states, "By November 2007, the PLA had deployed between 990 and 1,070 CSS-6 and CSS-7 short-range ballistic missiles (SRBM) to garrisons opposite Taiwan. It is increasing the size of this force at a rate of more than 100 missiles per year, including variants of these missiles with improved ranges, accuracies, and payloads."⁵

Although ballistic missiles in the past have traditionally been used to attack fixed targets on land, DOD and other observers believe China is developing TBMs equipped with maneuverable reentry vehicles (MaRVs) capable of hitting moving ships at sea. The weapons are referred to as anti-ship ballistic missiles (ASBMs). DOD states that

³ Unless otherwise indicated, shipbuilding program information in this section is taken from *Jane's Fighting Ships 2007-2008*, and previous editions. Other sources of information on these shipbuilding programs may disagree regarding projected ship commissioning dates or other details, but sources present similar overall pictures regarding PLA Navy shipbuilding.

⁴ Depending on their ranges, TBMs can be divided into short-, medium-, and intermediate-range ballistic missiles (SRBMs, MRBMs, and IRBMs, respectively).

⁵ 2008 DOD CMP, p. 2.

China is developing an anti-ship ballistic missile (ASBM) based on a variant of the CSS-5 medium-range ballistic missile (MRBM) as a component of its anti-access strategy. The missile has a range in excess of 1,500 km and, when incorporated into a sophisticated command and control system, is a key component of China's anti-access strategy to provide the PLA the capability to attack ships at sea, including aircraft carriers, from great distances.⁶

Observers have expressed strong concern about this development, because such missiles, in combination with broad-area maritime surveillance and targeting systems, would permit China to attack moving U.S. Navy ships in the Western Pacific. The U.S. Navy has not previously faced a threat from highly accurate ballistic missiles capable of hitting moving ships at sea. Due to their ability to change course, MaRVs would be more difficult to intercept than non-maneuvering ballistic missile reentry vehicles.

The CSS-6 is also known as the DF-21, and a MARV-equipped version of this missile has been referred to as the DF-21C.⁷ A July 2007 press report stated that one observer believes that a MARV-equipped version of the CSS-6 may be close to initial operational status.⁸

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. DOD stated in 2007 that "First- and second-generation LACMs may be deployed in the near future."⁹

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 that have been or are being acquired by the PLA Navy are the Russian-made SS-N-22 Sunburn (carried by China's four Russian-made Sovremenny-class destroyers) and the SS-N-27 Sizzler (carried by 8 of China's 12 Russian-made Kilo-class 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

⁶ 2008 DOD CMP, p. 2.

⁷ The MARV-equipped version of the missile was referred to as the DF-21C in a briefing by Robert O. Work and Thomas P. Ehrhard of the Center for Strategic and Budgetary Assessments (CSBA) presented on July 11, 2007, in room S-211 of the Capitol, entitled "The Unmanned Combat Air System Carrier Demonstration Program: A New Dawn for Naval Aviation?" See also Wendell Minnick, "China Developing Anti-Ship Ballistic Missiles," *Defense News*, January 14, 2008.

⁸ Bill Gertz, "Inside the Ring," *Washington Times*, July 20, 2007: 6. (Item entitled "New Chinese Missiles"). The article stated that it was reporting information from forthcoming report on China's military from the International Assessment and Strategy Center authored by Richard Fisher.

⁹ 2007 DOD CMP, p. 17.

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.¹⁰

Mines. China is believed to have an inventory of tens of thousands of naval mines of various types, including modern designs. Chinese naval publications demonstrate a strong interest in the use of naval mines in conflicts or blockade situations, and particularly for countering U.S. submarines. As some observers have noted,¹¹ detailed open-source discussions of China's naval mining capabilities are few in number. A recent example of such a discussion appeared in the Winter 2007 edition of *Undersea Warfare*, a publication of the U.S. Navy's submarine community.¹² See **Appendix B** for a lengthy excerpt from this article, as well as excerpts from other publications.

Nuclear Weapons¹³. 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,¹⁴ 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.

One set of observers states:

¹⁰ See, for example, Figure 9 (the map entitled "Taiwan Strait SAM and SRBM Coverage") in *2008 DOD CMP*, p. 42.

¹¹ See, for example, Norman Polmar, "Is There a Mine Threat?" *U.S. Naval Institute Proceedings*, February 2008: 88-89.

¹² Andrew Erickson, Lyle Goldstein, and William Murray, "China's Undersea Sentries," *Undersea Warfare*, Winter 2007, available online at [http://www.navy.mil/navydata/cno/n87/usw/issue_33/china.html]

¹³ For a general discussion of the potential role of nuclear weapons in notional crisis and conflict situations involving China, see CRS Report RL33607, *U.S. Conventional Forces and Nuclear Deterrence: A China Case Study*, by Christopher Bolkcom, Shirley A. Kan, and Amy F. Woolf.

¹⁴ 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.

In Chinese discussions of Russian ASW systems, there is a pointed recognition that the Soviets leaned heavily toward the use of tactical nuclear weapons (e.g., nuclear depth charges and torpedoes) in ASW operations. Tactical nuclear weapons are also mentioned in the context of mine warfare. An article in the July 2006 issue of [the Chinese military journal] *Modern Navy*, in discussing possible PLA Navy use of sea mines, suggests the potential combat value of nuclear-armed versions. It will be important to watch closely for any sign of Chinese efforts in this direction.¹⁵

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.¹⁶

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.¹⁷ 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 the order of only a few hundred yards,¹⁸ such devices could be used to attack

¹⁵ Gabriel Collins, Andrew Erickson, Lyle Goldstein, and William Murray, “Chinese Evaluations of the U.S. Navy Submarine Force,” *Naval College War Review*, Winter 2008: 79.

¹⁶ 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 I: 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.)

¹⁷ For more on HPM weapons, see CRS Report RL32544.

¹⁸ 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

individual U.S. Navy ships without the political or escalatory risks of a high-altitude nuclear detonation.¹⁹

Aircraft.

Land-Based Aircraft. China is introducing increasing numbers of modern and capable (so-called fourth-generation) land-based 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 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.

China's land-based naval aircraft inventory includes, among other things, 24 Russian-made Su-30 MKK 2 Flanker land-based fighters whose delivery was completed in 2004. The Su-30 is a derivative of the Su-27. Some of the Su-30s might eventually be fitted with the Russian-made Kh-35 ASCM. (China's air force operates at least 130 Su-27s; these aircraft could be used for fleet-defense operations.)

China's navy also operates 36 JH-7 land-based fighter-bombers that were delivered between 1998 and 2004. The planes can be armed with Chinese-made C-701, C-801, or C-802 ASCMs or laser-guided bombs, and might be fitted in the future to carry Russian-made Kh-31 ASCMs.

Carrier-Capable Aircraft. China reportedly has been negotiating with Russia on the purchase 48 to 50 carrier-capable Su-33 Flanker D naval fighters. The Su-33, a derivative of the Su-27 design, can operate from aircraft carriers using a ski-jump

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.)

¹⁹ 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.)

For additional discussion HPM weapons at sea, see Massimo Annati, "Non-Lethal Weapons: Their Application in the Maritime World," *Naval Forces*, No. 1, 2006, particularly pages 50, 51, and 53.

ramp and is capable of in-flight refueling.²⁰ Some sources state that China may create a carrier-capable version of its J-10 fighter.²¹

Unmanned Aerial Vehicles (UAVs). DOD stated in 2007 that “acquisition of UAVs and UCAVs,²² including the Israeli HARPY [UCAV], expands China’s options for long-range reconnaissance and strike.”²³ Another source stated in 2007 that “Chinese sources have also recently suggested that China is actively developing unmanned combat aircraft for carrier operations.”²⁴

Submarines. China’s submarine modernization effort, which is producing a significantly more modern and capable submarine force, has attracted substantial attention and concern. China by the end of 2006 completed taking delivery on eight Russian-made Kilo-class non-nuclear-powered attack submarines (SSs) that are in addition to four Kilos that China purchased from Russia in the 1990s.²⁵ China also has recently built or is building four other classes of submarines, including the following:

- a new nuclear-powered ballistic missile submarine (SSBN) design called the Jin class or 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 (or Type 039A);²⁶ and

²⁰ See, for example, Richard Fisher, Jr., “Chinese Dimensions of the 2007 Dubai Airshow,” online article available at [http://www.strategycenter.net/printVersion/print_pub.asp?pubID=179], and Keith Jacobs, “PLA-Navy Update,” *Naval Forces*, No. 1, 2007: 21, 24.

²¹ See John J. Tkacik, Jr., *China’s Quest for a Superpower Military*, Heritage Foundation Backgrounder No. 2036, May 17, 2007, pp. 12-13; Testimony of Richard D. Fisher, Jr., for a hearing held on March 16, 2006, before the U.S.-China Economic and Security Review Commission, pp. 5-6.

²² UCAV means unmanned combat aerial vehicle (i.e., an armed UAV).

²³ *2007 DOD CMP*, p. 18. The report stated further that “The Israelis transferred HARPY UCAVs to China in 2001 and conducted maintenance on HARPY parts during 2003-2004. In 2005, Israel began to improve government oversight of exports to China by strengthening controls of military exports, establishing controls on dual-use exports, and increasing the role of the Ministry of Foreign Affairs in export-related decisions.” (Page 28)

²⁴ Richard Fisher, Jr., “Chinese Dimensions of the 2007 Dubai Airshow,” online article available at [http://www.strategycenter.net/printVersion/print_pub.asp?pubID=179]

²⁵ 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.

²⁶ Some sources believe the Yuan class to be a variant of the Song class and refer to the Yuan class as the Type 039A.

- another (and also fairly new) SS design called the Song class or Type 039/039G.

Along with the Kilo-class boats, these four classes of indigenously built submarines are expected to be much more modern and capable than China's aging older-generation submarines.

Some sources state that a successor to the Shang class SSN design, called the Type 095 SSN design, is in development.²⁷

China's submarines are armed with one or more of the following: ASCMs, wire-guided and wake-homing torpedoes, and mines. China's eight recently delivered Kilos are reportedly armed with the highly capable SS-N-27 Sizzler ASCM. China's four older Kilos reportedly are to be refitted in Russia, with the upgrades possibly including the installation of the SS-N-27. In addition to other weapons, Shang-class SSNs may carry LACMs. Although ASCMs are often highlighted as sources of concern, wake-homing torpedoes can also be very difficult for surface ships to counter.

Each Jin-class SSBN is expected to be armed with 10 or 12 JL-2 nuclear-armed submarine-launched ballistic missiles.²⁸ DOD estimates that these missiles will enter service in 2009-2010,²⁹ and that they will have a range of 7,200 kilometers (about 3,888 nautical miles).³⁰ Such a range could permit Jin-class SSBNs to attack

- targets in Alaska (except the Alaskan panhandle) from protected bastions close to China;³¹

²⁷ See, for example, "2018 — deadline for Taiwan invasion?" a September 22, 2007, entry in a blog on China naval and air power maintained by an author called "Feng," available online at [<http://china-pla.blogspot.com/2007/09/2018-deadline-for-taiwan-invasion.html>].

²⁸ 2008 DOD CMP, p. 25.

²⁹ 2008 DOD CMP, p. 3.

³⁰ 2008 DOD CMP, p. 26 (Figure 4) and p. 56 (Figure 17).

³¹ A map published by DOD (2008 DOD CMP, p. 26 [Figure 4]) shows a range ellipse for the JL-2 which, upon inspection, appears to show the missile as having a range of no more than about 6,500 kilometers, rather than the 7,200 kilometers indicated in the legend to the map and elsewhere in the DOD report. In addition, the JL-2 range ellipse appears centered on a launching point that is more or less west of Shanghai and perhaps 200 or more statute miles inland from the sea. This combination of apparent range and launching point appears to be why the map shows the JL-2 as having sufficient range to attack only the western half of the Aleutian island chain and perhaps the western coast of mainland Alaska (the section of Alaska's coast that is directly opposite the Russian coast). A missile with a range of 7,200 kilometers that is launched from an ocean location close to China's eastern coast would have sufficient range to attack all of Alaska except the Alaskan panhandle.

DOD in 2007 assessed the range of the JL-2 as 8,000 kilometers (about 4320 nautical miles). (2007 DOD CMP, pp. 3, 19 [Figure 3], and 42 [Figure 14].) A map published in 2007 by DOD (2007 DOD CMP, p. 19 [Figure 3]) showed JL-2s with a range of 8,000 kilometers

- targets in Hawaii (as well as targets in Alaska, except the Alaskan panhandle) from locations south of Japan;
- targets in the western half of the 48 contiguous states (as well as Hawaii and Alaska) from mid-ocean locations west of Hawaii; and
- targets in all 50 states from mid-ocean locations west of Hawaii.

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

Table 1 shows actual and projected commissionings of Chinese submarines by class since 1995, when China took delivery of its first two Kilo-class boats. As shown in **Table 1**, observers expected China to have a total of 28 Shang, Kilo, Yuan, and Song class submarines in commission by the end of 2007.

Although **Table 1** shows a total of 13 Song-class boats, DOD states that China has a total of 10 Song-class boats.³² DOD also states that "The YUAN-class SS is now assessed to be in full production and will be ready for service by 2010."³³

Photos published on the Internet have suggested to some observers that China has launched and perhaps completed (if perhaps not officially placed into service) higher numbers of Jin-, Shang-, and Yuan-class submarines than shown in **Table 1**.³⁴

as capable of attacking targets in the continental United States that are north and west of a line running from central or southern California to northern Minnesota. For a missile with a range of 8,000 kilometers, the launching point that results in this target-coverage line is an inland location at or near the extreme northern tip of China — a location northeast of Mongolia that is roughly 700 statute miles inland from the sea, with the approximate geographic coordinates of 53°N, 125°E. This location also appeared to be the assumed launching point for some of the land-based ballistic missiles shown in the map. The JL-2 appears to have been assigned this inland launching point in the map to simplify the presentation of the target-coverage arcs shown in the figure.

³² 2008 DOD CMP, p. 4.

³³ 2008 DOD CMP, p. 4.

³⁴ See, for example, "PLA Navy Submarine Commissioning Observations," an April 11, 2008, entry in a blog on naval issues called "Information Dissemination," maintained by an author called "Galrahn," available online at [<http://informationdissemination.blogspot.com/2008/04/pla-navy-submarine-commissioning.html>].

Table 1. PLA Navy Submarine Commissionings
Actual (1995-2006) and Projected (2007-2010)

	Jin (Type 094) SSBN	Shang (Type 093) SSN	Kilo SS (Russian- made)	Yuan (Type 041) SS ^f	Song (Type 039) SS	Ming (Type 035) SS ^a	Total
1995			2 ^b			1	3
1996						1	1
1997						2	2
1998			1 ^b			2	3
1999			1 ^b		1		2
2000						1	1
2001					2	1	3
2002						1	1
2003					2		2
2004			1		3		4
2005			4		3		7
2006		1	3	1	2 ^c		7
2007		1 ^d					1
2008	1	n/a					n/a
2009		n/a		1			n/a
2010	1 ^e	n/a		n/a			n/a
2011		n/a		n/a			n/a
2012	1 ^e	n/a		n/a			n/a
2013		n/a		n/a			n/a
2014	1 ^e	n/a		n/a			n/a

Source: *Jane's Fighting Ships 2007-2008*, and previous editions.

Note: n/a = data not available.

- Figures for Ming-class boats are when the boats were launched (i.e., put into the water for final construction). Actual commissioning dates for these boats may have been later.
- First four boats, commissioned in the 1990s, are to be refitted in Russia; upgrades are likely to include installation of SS-N-27 ASCM.
- No further units expected after the 12th and 13th shown for 2006.
- Construction of a third ship (possibly to a modified design) may have started but has not been confirmed. A total of five boats is expected.
- Additional units are expected, perhaps at two-year intervals. A total of four boats is expected. (DOD stated in 2008 that up to five might be built. [2008 DOD CMP, p. 25])
- Some sources believe the Yuan class to be a variant of the Song class and refer to the Yuan class as the Type 039A.

The figures in **Table 1** show that between 1995 and 2007, China placed into service a total of 37 submarines, or an average of about 2.8 submarines per year. This average commissioning rate, if sustained indefinitely, would eventually result in a steady-state submarine force of 57 to 85 boats of all kinds, assuming an average submarine life of 20 to 30 years. Excluding the 12 Kilos purchased from Russia,³⁵

³⁵ Some observers might view the purchase of the 12 Kilos as a one-time event intended to jump-start the modernization of China's submarine force. Other observers, which conceding

total number of domestically produced submarines placed into service between 1995 and 2007 is 25, or an average of about 1.9 per year. This average rate of domestic production, if sustained indefinitely, would eventually result in a steady-state force of domestically produced submarines of 38 to 58 boats of all kinds, again assuming an average submarine life of 20 to 30 years.

As shown in **Table 1**, only two of the submarines placed into service between 1995 and 2007 are nuclear powered. If the mix of China's submarine-production effort shifts at some point to include a greater proportion of nuclear-powered boats, it is possible that the greater resources required to produce nuclear-powered boats might result in a reduction in the overall submarine production rate. If so, and if such a reduced overall rate were sustained indefinitely, it would eventually result in a smaller steady-state submarine force of all kinds than the figures calculated in the preceding paragraph.

One set of observers stated in 2007:

In order to grasp the energy that China is now committing to undersea warfare, consider that during 2002-2004 China's navy launched thirteen submarines while simultaneously undertaking the purchase of submarines from Russia on an unprecedented scale. Indeed, China commissioned thirty-one new submarines between 1995 and 2005. Given this rapid evolution, appraisals of China's capability to field competent and lethal diesel submarines in the littorals have slowly changed from ridicule to grudging respect of late. China's potential for complex technological development is finally being taken seriously abroad.³⁶

Another observer stated in 2007:

Looking ahead, further modern conventional boats are expected to be constructed as the 27 older and less capable units (Romeo and Ming classes) are paid off [i.e., retired] and, while predictions are hazardous, an overall force level of about 40-50 boats is expected.³⁷

Another observer stated in 2007:

China's submarine fleet is now considered the PLAN's most "potent strength." Since 1995, the PLAN has commissioned about 31 new submarines, including two nuclear-powered submarines based on advanced Russian technology. Eight submarines were commissioned in 2005, and seven were commissioned in 2006, including new Song-class boats and a Yuan-class boat heavily inspired by Russia's Amur-class sub with its anechoic tile coatings and quiet seven-bladed skewed propeller. The reported incorporation of "air-independent propulsion" systems that permit submarines to operate

the value of the 12 Kilos in jump-starting the modernization effort, might argue that additional foreign purchases of Russian-made submarines in the future are still quite possible.

³⁶ Andrew S. Erickson and Lyle J. Goldstein, "China's Future Submarine Force: Insights From Chinese Writings," *Naval War College Review*, Winter 2007: 55.

³⁷ *Jane's Fighting Ships 2007-2008*, p. 31 (Executive Overview).

underwater for up to 30 days would make the Song and Yuan submarines virtually undetectable to existing U.S. surveillance networks.

In addition, China has three new nuclear-powered submarine design and construction programs. The Type-093 Shang-class nuclear attack boat and the Type-094 Jin-class nuclear ballistic missile submarine programs are underway. Two Shang submarines are deployed, and three are under construction, and five Jin-class ballistic missile submarines are reportedly under construction. Five Type-095 submarines, a larger version of the Shang/Jin hull, are also under development. Together with its procurement program for improved Russian-made Kilo-class submarines, China has at least six new submarine programs under way simultaneously — a submarine development campaign that is unprecedented in peacetime. China will have at least 34 advanced submarines deployed in the Pacific by 2010 — some analysts expect as many as 50 to 60 — assuming that those under construction will be completed within three years. China will certainly have over 60 advanced submarines by 2020.³⁸

Another observer stated in 2007:

Although China is modernizing its submarine force, it is not “expanding” it. Since the mid-1980s, the force has been in steady decline from nearly 120 boats to roughly 55 operational submarines today. The U.S. Navy expects the force will level out around 40 boats in the next decade.

The decline of the submarine fleet is part of a transition where large older classes are being phased out and replaced with newer but less numerous submarine classes.³⁹

Another source stated in 2007:

We were seeing 3 to 4 [Type] 039s launched per year when it was finally in mass production. We have seen either the 2nd or the 3rd unit of 039A [aka Type 041] Yuan class under construction recently. It looks like PLAN has finally sorted out enough issues in [the] Yuan [class design] to mass produce it. I’m guessing we will see 3-6 [Type] 039As coming out a year for the next couple of years. And after that, we will see the successor to the 039 class.⁴⁰

This source also stated in 2007:

The mass production of Yuan ([Type] 039A) [class boats] has recently started. It’s hard to see that this will continue more than the mass production run of 3rd variants of [the] Song [class design]. So, we might see 10 Yuan at most.

³⁸ John J. Tkacik, Jr., *China’s Quest for a Superpower Military*, Heritage Foundation Backgrounder No. 2036, May 17, 2007, pp. 9-10. A footnote at the end of this quoted passage states: “Including at least five Type-94 Jins, five Type-093 Shangs, five Type-095s, one Yuan, 13 Songs, and 13 Kilo 877s and 636s.”

³⁹ Federation of American Scientists (FAS), “China’s Submarine Fleet Continues Low Patrol Rate,” published online at [<http://fas.org/blog/ssp/2007/02/>].

⁴⁰ “PLAN looking forward to 2008,” a December 23, 2007, entry in a blog on China naval and air power maintained by an author called “Feng,” available online at [<http://china-pla.blogspot.com/2007/12/plan-looking-forward-to-2008.html>]

Although, I think China will soon be developing a class of conventional submarine to match [the German] U-214, [the French] Scorpene and [the Russian] Amur [designs]. I'm guessing [the Japanese] Oyashio and [the Australian] Collins [class designs] are still in a league of their own. Either way, this new class will most likely endure a long initial production process like [the] Song [class] did before mass production. Although judging from Song's production of 4 per year (at its height), it shouldn't be long before [the] Yuan [class] or this new diesel class replace[s] all the Mings plus earlier [the] Song class submarines.⁴¹

Although China is modernizing its submarine force through the construction of new boats, one report, citing U.S. Navy data (see **Table 2**), shows the annual rate of Chinese submarine patrols to be relatively low.

Table 2. Chinese Submarine Patrols Per Year, 1981-2007

81	82	83	84	85	86	87	88	89	90	91	92	93	94
1	0	2	2	2	1	1	5	2	0	1	1	0	1
95	96	97	98	99	00	01	02	03	04	05	06	07	
1	1	2	3	2	6	3	4	3	3	0	2	6	

Source: Federation of American Scientists (FAS), "Chinese Submarine Patrols Rebound in 2007, but Remain Limited," published online at [http://www.fas.org/blog/ssp/2008/01/chinese_submarine_patrols_rebo.php]. FAS states in the online article that it received the data from the U.S. Navy under the Freedom of Information Act (FOIA).

The Federation of American Scientists (FAS), which published the figures shown in **Table 2**, states:

China's entire fleet of approximately 55 general-purpose submarines conducted a total of six patrols during 2007, slightly better than the two patrols conducted in 2006 and zero in 2005.

The 2007 performance matches China's all-time high of six patrols conducted in 2000, the only two years since 1981 that Chinese submarines conducted more than five patrols in a single year.

The new information, obtained by Federation of American Scientists from the U.S. Navy under the Freedom of Information Act, also shows that none of China's ballistic missile submarines have ever conducted a deterrent patrol.

In Perspective

Just what constitutes a Chinese "patrol" is secret, according to the U.S. Navy, but it probably refers to an extended voyage away from the homeport area (see here for further definitions). The seven Chinese patrols conducted in 2007 is but a fraction of the number of patrols conducted by the U.S. submarine force,

⁴¹ "2018 — deadline for Taiwan invasion?" a September 22, 2007, entry in a blog on China naval and air power maintained by an author called "Feng," available online at [<http://china-pla.blogspot.com/2007/09/2018-deadline-for-taiwan-invasion.html>].

which musters well over 100 patrols per year. But a comparison of U.S. and Chinese submarine patrol levels is not possible because the two navies have very different missions. China has no overseas military commitments and uses its submarine fleet almost exclusively as a coastal defense force, whereas the U.S. submarine force is constantly engaged in forward operations alone or with allies.

The Chinese patrol rate compares better with that of the Russian Navy, which has largely ceased forward submarine operations compared with those of the Soviet Union during the Cold War. Russian general purpose submarines conducted seven patrols in 2007.

In historic perspective, the six Chinese submarine patrols conducted in 2007 continues a trend that China in this decade has sent slightly more submarines on patrol than during the 1990s. Whereas Chinese submarines in the 1990s conducted an average of 1.2 patrols each year, the average has been 3.4 patrols since 2000.

About Those Boomers

Twenty-five years after it launched its first ballistic missiles submarine, Xia (Type 092), China has yet to conduct its first deterrent patrol. The new information confirms that neither the Xia, nor the two new Jin-class (Type 094) ballistic missile submarines — the first of which was launched in 2004 — have ever conducted a deterrent patrol....

Implications

Despite the rebound in general purpose submarine patrols, dramatic reports from recent years about Chinese submarines operating inside Japanese territorial waters or surfacing close to U.S. aircraft carriers have been largely absent in 2007. The meaning of the patrol rebound is yet unclear. After all, it follows a complete absence of submarine patrols in 2005, the fourth year since 1981 that China's submarine fleet did not conduct any patrols despite introduction of several new classes of more advanced submarines for greater reach. That modernization has (not yet) manifested itself in the form of a clear increase in submarine patrols.

The patrol number does not say anything about what the submarines did during the six patrols. They might have been basic attempts to sail far from shore to test navigational equipment or communication with the homebase, or they might have included more advanced tactical operations. They might have been conducted by six different submarines, or only a couple.

Yet for the Chinese submarine force overall, six patrols do not provide very much operational experience for more than 50 submarines and their crews. If China did plan a more extended reach for its submarine force, one might expect the patrol rate to continue to increase in the next couple of years. Only the future will tell. But the operational experience from the 55 patrols conducted by the entire submarine force between 1981 and the end of 2007 suggests that China's submarine force - at least for now - remains a coastal defense force.⁴²

⁴² Hans M. Kristensen, "Chinese Submarine Patrols Rebound in 2007, but Remain Limited," *Federation of American Scientists Strategic Security Blog*, available online at

Another observer, expressing a different view on the issue of the frequency of Chinese submarine patrols, stated in 2007 that “Chinese submarines slip out into open seas from underwater tunnels and are virtually undetectable.” Regarding an October 2006 incident involving a Song-class SS that surfaced near the U.S. aircraft carrier Kitty Hawk while it was operating near Okinawa, this observer stated that after the submarine was detected on the surface, the submarine “submerged and disappeared, defeating all U.S. anti-submarine warfare (ASW) efforts to detect it.” The observer stated that

The ease with which the submarine maneuvered undetected into Japanese waters and evaded U.S. and Japan Self Defense Force submarine sensors suggests that China’s large submarine fleet engages in far more sea patrols than the U.S. has any hope of tracking.⁴³

Another observer states that the October 2006 incident involving the Song-class SS was

in contrast to claims that the Chinese submarine fleet conducted only two patrols in 2006, according to information declassified by the U.S. Navy and obtained by the Federation of American Scientists under the Freedom of Information Act. Such relative inactivity seems at first extraordinary but can at least partly be explained by probable ambiguity about what constitutes a “patrol.” However, a more obvious reason is that half of China’s 26 modern (Yuan, Song, Kilo class) submarines have entered service since 2004 and it would be surprising if it was not proving difficult to build up the necessary levels of training and experience before more frequent out-of-area deployments can be undertaken.⁴⁴

Aircraft Carriers. The issue of whether and when China might deploy one or more aircraft carriers, and what the design and capabilities of Chinese aircraft carriers might be, has been a topic of discussion among observers for the last several years. Developments since mid-2005 have suggested to some observers that China now intends to complete the unfinished ex-Russian carrier Varyag, which China purchased from Russia several years ago, and place it into service in the near future, possibly as an aviation training ship.

The Varyag has an estimated full load displacement of about 58,500 tons, compared to about 100,000 tons for a U.S. Navy Nimitz (CVN-68) class aircraft carrier, about 42,000 tons for the French aircraft carrier Charles de Gaulle (which was commissioned in 2001), and about 65,000 tons to 70,000 tons for aircraft carriers that the United Kingdom and France plan to commission into service between 2013 and 2016. It is estimated that the Varyag can embark an air wing of 18 Su-33 Flanker fighters, compared to 70 or more aircraft on a Nimitz-class carrier, 36 aircraft on the Charles de Gaulle, and 40 to 45 aircraft on the future UK and French carriers.

[http://www.fas.org/blog/ssp/2008/01/chinese_submarine_patrols_rebo.php].

⁴³ John J. Tkacik, Jr., *China’s Quest for a Superpower Military*, Heritage Foundation Backgrounder No. 2036, May 17, 2007, pp. 9 and 10.

⁴⁴ *Jane’s Fighting Ships 2007-2008*, p. 31 (Executive Overview).

One source stated in 2007 that “Beijing statements allude more consistently to a 3-carrier force requirement, which may or may not include the ex-Varyag.... Were a Chinese carrier contract finalised in 2006, it would be 2011 before launching and 2014 before commissioning; a second ship could follow in 2016.”⁴⁵

Another source stated in 2007 that “Interestingly, a U.S. source that recently spoke with high PLA Navy officers relayed to the IASC [International Assessment and Strategy Center] that these officers stated that China would eventually build four to six aircraft carriers. In 2007 Chinese officials have been more willing to acknowledge their ambitions to build large aircraft carriers, an ambition that had previously been consistently denied.”⁴⁶

DOD states that “China has an active aircraft carrier research and design program. If the leadership were to so choose, the PRC shipbuilding industry could start construction of an indigenous platform by the end of this decade.”⁴⁷ DOD also states that:

There does not appear to be evidence that China has begun construction of an aircraft carrier. However, evidence in recent years increasingly suggests China’s leaders may be moving forward with an aircraft carrier program. For example, beginning in early 2006 and with the release of China’s Eleventh Five Year Plan, PRC-owned media reported on statements from high-level government and military officials on China’s intent to build aircraft carriers — including a March 2007 statement from the then-minister of China’s Commission on Science, Technology and Industry for National Defense (COSTIND). Continued renovations to the former Soviet Kuznetsov-class aircraft carrier suggest China may choose to use the platform for training purposes. Moreover, Russian press has reported Chinese interest in acquiring Russian Su-33 carrier-borne fighters. In October 2006 a Russian press report suggested early-stage negotiations were underway for China to purchase up to 50 such aircraft at a cost of \$2.5 billion. However, there has been no announcement of a contract for the aircraft.

Analysts in and out of government project that China could not have an operational, domestically-produced carrier before 2015. However, changes in China’s shipbuilding capability and degree of foreign assistance to the program could alter those projections.⁴⁸

Another observer projects that China will return the Varyag to service in 2008, possibly under the name Shi Lang, and that the ship might become fully operational as an aviation training ship in 2010:

Procurement of an aircraft carrier capability has been a high priority for the Chinese Navy since the 1990s. Ex-Varyag, the second of the Kuznetsov class

⁴⁵ Keith Jacobs, “PLA-Navy Update,” *Naval Forces*, No. 1, 2007: 24.

⁴⁶ Richard Fisher, Jr., “Chinese Dimensions of the 2007 Dubai Airshow,” online article available at [http://www.strategycenter.net/printVersion/print_pub.asp?pubID=179]

⁴⁷ 2008 DOD CMP, p. 4.

⁴⁸ 2008 DOD CMP, p. 38.

(the first of class, Admiral Kuznetsov, remains in service in the Russian Navy) was between 70 and 80 per cent complete by early 1993 when building was terminated after an unsuccessful attempt by the Russian Navy to fund completion. Subsequently the ship was bought by China and, having been towed through the Bosphorus on 2 November 2001, arrived at Dalian in March 2002. Since then, there have been conflicting reports about Chinese plans for the ship but, following its emergence from dock in mid-2005 painted in military colours, it is likely that it is intended to bring the ship into operational service. Work in 2006 included the apparent application of a non-skid surface to the flight deck. Reports in November 2006 that China was negotiating to procure up to 50 Sukhoi Su-33 fighters was a further indicator of Chinese intentions. A further major docking period is probably required to fit shafts and/or propellers and to complete survey and renovation of hull fittings....

Initial sea trials are expected to start in 2008 after which an extensive period of trials and training is likely to follow. It is unlikely that the ship will begin operational flying training until about 2010. The ship's (unconfirmed) pennant number [83] suggests that her initial status will be as a training ship. The aircraft inventory is not yet known but is likely to comprise a mixture of Russian-built fixed-wing aircraft and helicopters. The ship's name has also not been confirmed; Admiral Shi Lang was commander-in-chief of the Manchu fleets which conquered Taiwan in 1681.⁴⁹

Another observer presented a somewhat alternate view in 2007, stating that:

The [new ship] that is probably most anticipated [for 2008] is the aircraft carrier. Most people suspect that we will see this in JiangNan shipyard.... I do believe that many of the suppliers have already delivered the necessary components [for this ship]. I also believe that the ship will start construction in 2008, but we might not see anything useful for another 2 years. What about Varyag? We've been waiting for progress ever since the second half of 2005 when the ship was first painted in PLAN colour. Since then, we've seen some progress, but this [past] year [i.e., 2007] hasn't brought about that much [change]. The conventional wisdom is that China bought Varyag for study and for training/preparing a future naval air wing. As time goes by, I have more and more doubts toward latter. I almost feel like Varyag is being displayed as a decoy of some sort. It is there to grab people's attention on this old ship, and away from

⁴⁹ *Jane's Fighting Ships 2007-2008*, p. 122. This source similarly states at another point that work being done on

the ex-Russian carrier Varyag (possibly to be named Shi Lang), continued at Dalian during 2006 and there now seems little doubt that the ship is destined to become the first Chinese aircraft carrier. The announcement in October 2006 by Rosoboron export, Russia's arms export agency, that the Chinese government was in negotiations to buy up to 50 Su-33 naval fighters was a clear indication of intentions. A tentative timetable is for the ship to begin sea trials in 2008 with a view to commencing operational flying training in about 2010. It may be some years after that before the ship becomes fully operational and its initial status is likely to be as a training ship and as a test-bed for the development of China's indigenous carrier programme.

(*Jane's Fighting Ships 2007-2008*, p. 31 [Executive Overview])

works on China's first indigenous carrier. Obviously, I'm not expecting much progress in Varyag in 2008.⁵⁰

This source also stated in 2007 that:

there are some rumours recently that the [indigenous] carrier projects will start in both Dalian and Shanghai shipyards. I'm not surprised that two will be built, but I didn't think Dalian would get any work.... They are supposedly looking for something that is 60k+ in standard displacement, 317 m long, 70+ m wide and [an ability to] carry 55+ aircrafts (of which 30+ [would be] J-11Cs, [plus] some number of helicopters and possibly Y-7 AEWs).... At this point, I'd generally take the cost rumours with a grain of salt. However, the carrier dimensions is from a much better source and seems to be comparable to Varyag dimensions (although a little larger). I do expect to see catapults on the first generation of Chinese carriers.⁵¹

Surface Combatants. China since the early 1990s has purchased four Sovremenny-class destroyers from Russia and deployed nine new classes of indigenously built destroyers and frigates (some of which are variations of one another) that demonstrate a significant modernization of PLA Navy surface combatant technology. DOD states that China's newest indigenously built destroyers and frigates "reflect leadership's priority on advanced anti-air warfare capabilities for China's naval forces, which has historically been a weakness of the fleet."⁵² China has also deployed a new kind of missile-armed fast attack craft that uses a stealthy catamaran hull design.

Sovremenny-Class Destroyers. China in 1996 ordered two Sovremenny-class destroyers from Russia; the ships entered service in 1999 and 2001. China in 2002 ordered two additional Sovremenny-class destroyers from Russia; the ships entered service in 2005 and 2006. Sovremenny-class destroyers are equipped with the SS-N-22 Sunburn ASCM, a highly capable ASCM.⁵³ DOD stated in 2007 that the two ships ordered in 2002 "are fitted with anti-ship cruise missiles (ASCMs) and wide-area air defense systems that feature qualitative improvements over the [two] earlier SOVREMENNY-class DDGs China purchased from Russia."⁵⁴ In light of these improvements, DOD refers to these two ships as Sovremenny II class destroyers.⁵⁵ China reportedly has an option for another two Sovremenny-class ships.

⁵⁰ "PLAN looking forward to 2008," a December 23, 2007, entry in a blog on China naval and air power maintained by an author called "Feng," available online at [<http://china-pla.blogspot.com/2007/12/plan-looking-forward-to-2008.html>]

⁵¹ "Latest from PLAN," a November 17, 2007, entry in a blog on China naval and air power maintained by an author called "Feng," available online at [<http://china-pla.blogspot.com/2007/11/latest-from-plan.html>].

⁵² 2008 DOD CMP, pp. 4-5.

⁵³ 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.

⁵⁴ 2007 DOD CMP, p. 3. The DOD report spells Sovremenny with two "y"s at the end.

⁵⁵ 2008 DOD CMP, p. 2.

Five New Indigenously Built Destroyer Classes. China since the early 1990s has built five new classes of destroyers, one of which is a variation of another. Compared to China's 16 older Luda (Type 051) class destroyers, which entered service between 1971 and 1991, these five 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, 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 3**, China to date has commissioned only 1 or 2 ships in each of these five classes, suggesting that at least some of these classes might have been intended 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.⁵⁶

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. DOD stated in 2008 that the Luyang I design is equipped with the Russian-made SA-N-7B Grizzly SAM and the Chinese-made YJ-83 ASCM.⁵⁷

Table 3. 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
Luzhou	051C	2	115, 116	2006, 2007

Source: *Jane's Fighting Ships 2007-2008*.

⁵⁶ One source says the limited production runs of these four designs to date "might be financially related, or may relate to debate over what ships should follow the Type 051C air defence and Type 052C multi-role classes, or that once the Type 054A [frigate design] is accepted as the future missile frigate design, three or four of the major warship shipyards will all be assigned to construction of this design, delaying a future CG/DDG class." (Keith Jacobs, "PLA-Navy Update," *Naval Forces*, No. 1, 2007: 24.) Another source stated in 2007 that "It looks like [the] 052C [class] was stopped for a few years due to [the] JiangNan relocation [and the] sorting out [of] all the issues on [the] 052B/C [designs]." ("2018 — deadline for Taiwan invasion?" a September 22, 2007, entry in a blog on China naval and air power maintained by an author called "Feng," available online at [http://china-pla.blogspot.com/2007/09/2018-deadline-for-taiwan-invasion.html].)

⁵⁷ 2007 DOD CMP, pp. 3-4

The **Luyang II-class ships** appear to feature an even more capable AAW system that includes a Chinese-made SAM system called the HHQ-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.⁵⁸

DOD stated in 2007 the **Luzhou-class design** “is designed for anti-air warfare. It will be equipped with the Russian SA-N-20 SAM system controlled by the TOMBSTONE phased-array radar. The SA-N-20 more than doubles the range of current PLA Navy air defense systems marking a significant improvement in China’s ship-borne air defense capability.”⁵⁹ Both Luzhou-class ships have conducted sea trials and are expected to enter service during 2007.⁶⁰

If one or more of these destroyer designs (or a successor design) are put into larger-scale production, it would accelerate the modernization of China’s surface combatant force. One source stated in 2007 that:

All signs are pointing to laying down of the successor to 052C [design] in the beginning of next year [2008]. There is a lot of speculations on what would be size and armament on this ship. Many people have also speculated it to be the first class of massed produced Destroyers after [the] Luda class.⁶¹

This source also stated in 2007 that:

the new generation [Type] 052D [class] is suppose[d] to start construction in early 2008 in Changxin. We could easily see production of 2 or more per year until there are enough to replace the Ludas. Of course, each iteration will be slightly better than the previous one.⁶²

Four New Indigenously Built Frigate Classes. China since the early 1990s has built four new classes of frigates, two of which are variations of two others, that are more modern than China’s 31 older Jianghu (Type 053) class frigates, which entered service between the mid-1970s and 1989. The four new frigate classes, like the new destroyer classes, feature improved AAW capabilities. Unlike the new destroyer designs, some of the new frigate designs have been put into larger-scale series production. **Table 4** summarizes the three new classes.

⁵⁸ For a detailed article about the Luyang II class, see James C. Bussert, “China Debuts Aegis Destroyers,” *Signal*, July 2005, pp. 59-62.

⁵⁹ *2007 DOD CMP*, p. 3.

⁶⁰ *Jane’s Fighting Ships 2007-2008*, p. 31 (Executive Overview).

⁶¹ “PLAN looking forward to 2008,” a December 23, 2007, entry in a blog on China naval and air power maintained by an author called “Feng,” available online at [<http://china-pla.blogspot.com/2007/12/plan-looking-forward-to-2008.html>]

⁶² “2018 — deadline for Taiwan invasion?” a September 22, 2007, entry in a blog on China naval and air power maintained by an author called “Feng,” available online at [<http://china-pla.blogspot.com/2007/09/2018-deadline-for-taiwan-invasion.html>].

Table 4. 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 I	054	2	525, 526	2005
Jiangkai II	054A	4	530 (lead ship)	2007-2008

Source: *Jane's Fighting Ships 2007-2008*.

Construction of **Jiangwei I-class ships** appears to have ceased. It is unclear whether construction of **Jiangwei II-class ships** will continue after the 10th ship.

The **Jiangkai I-class ships** feature a stealthy design that somewhat resembles France's La Fayette-class frigate, which first entered service in 1996.⁶³ The **Jiangkai II-class ships** are a modified version of the Jiangkai I-class design that features a VLS system for its SAMs. One observer states, "Under construction at two shipyards, it is likely that this design will be built in sufficient numbers to replace the ageing Jianghu class frigates."⁶⁴ Another source similarly stated in 2007 that a total of 28 to 30 Type 054A frigates "are believed scheduled" for production to replace China's older-generation frigates.⁶⁵

Fast Attack Craft. In addition to its 190 older fast attack craft, or FACs (including 37 armed with ASCMs), China in 2004 introduced a new type of ASCM-armed fast attack craft, called the Houbei class (or, by some sources, the Type 022 class), that uses a stealthy, wave-piercing, catamaran hull. The Houbei class is being built in at least six shipyards. At least 25 were in service as of 2007, and a total of at least 40 are expected.⁶⁶ One source stated in 2007 that:

We've seen an astonishing number of [Type] 022s come out this [past] year [i.e., 2007]. I originally estimated that the 022s will stop production by 2011. However, it seems like 022 production will finish as early as next year [2008] if this production rate continues. The production almost confuses me, because PLAN has not shown this kind of urgency with any of its other recent platforms. It brings us to the next point. It looks like 022 is replacing [older Type] 021/024/037 [ships] in the FAC/patrol kind of role. How many does [the] PLAN

⁶³ 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.

⁶⁴ *Jane's Fighting Ships 2007-2008*, p. 129. This source states at another point that on October 12, 2006, China launched (i.e., put into the water for final construction) "the first of what is expected to be a large class of Jiangkai II [class] ships. Noteworthy features include a vertical-launch system for the HHQ-16 missile." (*Jane's Fighting Ships 2007-2008*, p. 31 [Executive Overview].)

⁶⁵ Keith Jacobs, "PLA-Navy Update," *Naval Forces*, No. 1, 2007: 26.

⁶⁶ *Jane's Fighting Ships 2007-2008*, p. 31 (Executive Overview) and p. 136.

really need[?] I mentioned 100 as the number a year ago and was laughed at by certain people. It now appears China might get even more than that if the production like this continues until 2010.⁶⁷

In addition to the Houbai class, one source stated in 2007 that China in 2005 ordered 24 to 30 **Molniya-class** ASCM-armed fast attack craft from Russia. The Molniya class is an upgraded version of the Russian Tarantul-class design that might be armed with four SS-N-22 ASCMs. The first four, according to this source, may be delivered by late-2007 or early-2008.⁶⁸

Amphibious Ships.

Type 071 Amphibious Ship. China is building a new class of amphibious ship called the **Type 071 class**. The design has an estimated displacement of about 17,600 tons, compared with about 15,900 tons to 16,700 tons for the U.S. Navy's Whidbey Island/Harpers Ferry (LSD-41/49) class amphibious ships, which were commissioned into service between 1985 and 1998, and about 25,900 tons for the U.S. Navy's new San Antonio (LPD-17) class amphibious ships, the first of which was commissioned into service in 2006. The first Type 071 ship is expected to enter service in 2008. The Type 071 design features a hull with clean, sloped sides — a design that resembles the hulls of modern western amphibious ships and appears intended to reduce the ship's visibility to radar.

Report of Potential Type 081 Amphibious Ship. In August 2007, it was reported that China might begin building a larger amphibious ship, called the Type 081, that might displace 20,000 tons.⁶⁹

Other New Amphibious Ships and Landing Craft. In addition to the Type 071 design, China between 2003 and 2005 commissioned into service three new classes of smaller amphibious ships and landing craft. Each type was built at three or four shipyards. Between these three other classes, China commissioned into service a total of 20 amphibious ships and 10 amphibious landing craft in 2003-2005. Additional units in some of these classes are possible. China also has numerous older amphibious ships and landing craft of various designs.

Mine Countermeasures (MCM) Ships. China is building two new classes of mine countermeasures (MCM) ships called the Wozang class and the Wochi class. One observer states that "modernisation plans for the mine-countermeasures force are difficult to discern. The first Wozang class [ship] entered service in 2005 and

⁶⁷ "PLAN looking forward to 2008," a December 23, 2007, entry in a blog on China naval and air power maintained by an author called "Feng," available online at [<http://china-pla.blogspot.com/2007/12/plan-looking-forward-to-2008.html>]

⁶⁸ Keith Jacobs, "PLA-Navy Update," *Naval Forces*, No. 1, 2007: 27.

⁶⁹ See Richard D. Fisher Jr., "Naval Gazing, Emerging Expeditionary Capabilities in the Western Pacific," *Jane's Intelligence Review*, August 2007: 55; and "PLAN looking forward to 2008," a December 23, 2007, entry in a blog on China naval and air power maintained by an author called "Feng," available online at [<http://china-pla.blogspot.com/2007/12/plan-looking-forward-to-2008.html>]

was expected to replace the [existing] T-43 [class mine warfare ship]s, albeit that the design looked very similar. This ship was then followed in 2006 by a longer version known as the Wochi class. Little is known about the capabilities of either vessel.”⁷⁰

C4ISR Systems. C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) systems are viewed as increasingly important in terms of maximizing a military force’s capability, particularly in terms of obtaining timely, accurate targeting information for precision-guided weapons. A highly capable C4ISR capability can permit the formation of a networked military force composed of many widely separated units that can rapidly collect information from various sensors in the force and share that information among various units in the force. Effective networking through capable C4ISR systems is viewed by some observers as enabling a more highly capable approach to warfare sometimes referred to in U.S. discussions as network-centric warfare or network-centric operations.⁷¹ Chinese discussions of this issue similarly refer to military operations under “informatized” conditions.

One set of observers states that:

For many years, the entire PLA, including the PLAN, faced major shortcomings in its C4ISR capabilities, but Beijing has embarked on a massive effort to modernize, upgrade and expand its communications infrastructure. One of the key results of this communications upgrade, which has been bolstered by the rapid development of China’s civilian information technology and telecommunications industries, was the construction of a national fiberoptic communications network that provides the PLA with much greater communications capacity, reliability and security. According to one source, “in the coastal military commands, a gigantic optic-cable communication network has been set up, which guarantees the optic-cable communication among the headquarters of each military command. Meanwhile, satellite communication has been applied more widely, which ensures smooth communication between the top commanding organ and the headquarters at different levels of the military commands.” Chinese research institutes have also “developed a VSAT [Very Small Aperture Terminal] communication system consisting of mobile vehicle-borne components” as well as new microwave and troposcatter communication systems. Additionally, China is upgrading some of its traditional HF, VHF and UHF communication systems. Improving military computer networks and making them available to more and more units also has been a priority for the PLA as it expands its communications networks, another key “informatization” development that has major implications for the PLAN. Indeed, recent reports indicate that all PLAN units at the division level and above are now connected to military computer networks, and that current plans focus on extending coverage to lower-level units.

⁷⁰ *Jane’s Fighting Ships 2007-2008*, p. 31 (Executive Overview) and p. 136.

⁷¹ For more on network-centric warfare and network-centric operations, see CRS Report RL32411, *Network Centric Operations: Background and Oversight Issues for Congress*, by Clay Wilson. See also CRS Report RS20557, *Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress*, by Ronald O’Rourke.

Beijing has likewise intensified its efforts to improve its space-based C4ISR capabilities, which are particularly crucial for naval informatization. Navigation and positioning has been another major area of emphasis with implications for military modernization and the informatization of the PLAN. In addition to using GPS and GLONASS and working with the EU on the Galileo navigation satellite system, China has deployed the indigenous built Beidou Navigation System-1 comprised of four satellites, and plans to develop a larger system called Compass (or Beidou-2) comprised of thirty-five satellites. Chinese developments in small satellites and maritime observation satellites are also of particular interest from the perspective of naval informatization. In addition, the PLAN is improving the capabilities of its ocean survey and reconnaissance ships, which are responsible for a number of tasks, including surveying, gathering meteorological and hydrographic information, laying and repairing undersea cables, and intelligence collection....

One major area of emphasis appears to be the development of C4ISR capabilities required to implement an access denial strategy....

Chinese researchers also emphasize the importance of linking platforms together into an integrated whole, suggesting that this will continue to be a major focus of defense R&D programs. This is considered particularly important for the PLAN....

Unmanned reconnaissance systems appear to be another area of emphasis in Chinese C4ISR-related research. Indeed, recent technical articles indicate that Chinese scientists and engineers are conducting research on various types of unmanned aerial vehicles (UAVs). Chinese researchers are also working on unmanned underwater vehicles (UUVs).⁷²

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 maintenance 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.

China's 2004 defense white paper⁷³ stated an intention to improve in these areas, and observers believe the PLA is acting on these intentions. The PLA in recent years has developed a doctrine for joint operations involving multiple military services, improved its military education and training and conducted more realistic exercises, and reformed its logistics system. The Department of Defense (DOD) stated in 2005

⁷² Andrew S. Erickson and Michael S. Chase, "PLA Navy Modernization: Preparing for 'Informatized' War at Sea," *China Brief*, February 29, 2008: 3-4.

⁷³ China published defense white papers in 2006 and 2004; they are entitled *China's National Defense in 2006* and *China's National Defense in 2004*. (Hereafter cited as *2006 China White Paper* and *2004 China White Paper*.) The English-language texts of the papers can be found on the Internet at [<http://www.fas.org/nuke/guide/china/doctrine/wp2006.html>] and [<http://www.fas.org/nuke/guide/china/doctrine/natdef2004.html>].

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.”⁷⁴ DOD states that:

The PLA’s ongoing military reforms emphasize building a qualified officer and NCO corps. Many of the PLA’s investments in human capital are described in the 2004 Defense White Paper as elements of the “Strategic Project for Talented People,” which focuses on personnel management, education, and training reforms. The 2006 Defense White Paper reiterated the importance of training and educational reforms in addition to improving morale and welfare in the military. Improvements in the quality of personnel will continue to parallel broader force structure, doctrine, and training reforms across the PLA as it seeks to build a force able to fight and win “local wars under conditions of informatization.”⁷⁵

DOD also states that:

The PLA is compiling and validating a new Outline for Military Training and Evaluation (OMTE) to align its military training with its vision for transformation for warfare under “informatized conditions.” The new OMTE will emphasize realistic training conditions, training in electromagnetic and joint operations environments, and integrating new and high technologies into the force structure.⁷⁶

DOD states that in addition to improving the education level of people brought into the military,

An equally important aspect of the PLA’s modernization is enhancing the realism and quality of military training. During the Army-Wide Military Training Conference in 2006, the CMC announced training would be more robust and information-intensive to better prepare the PLA to face technologically advanced adversaries.

The PLA General Staff Department (GSD) 2007 training guidelines indicate the PLA expects training scenarios to resemble actual combat conditions as closely as possible. The PLA is attempting to enhance the level of realism by incorporating opposing forces into its exercises and, in some cases, by designing training that compels officers to deviate from the scripted exercise plan. The PLA is also conducting more joint service exercises. Although these efforts tend to be based more on de-confliction than truly joint operations, they do signify that the PLA is attempting to prepare its officers and soldiers for the demands of the future battlefield. In addition, the PLA is utilizing simulators to increase training time and conducting more command post exercises to improve its officers’ planning and decisionmaking skills.⁷⁷

⁷⁴ U.S. Department of Defense, *Annual Report to Congress [on] Military Power of the People’s Republic of China 2005*. Washington, 2005. p. 26. (Hereafter *2005 DOD CMP*. Editions for other years cited similarly.) p. 26.

⁷⁵ *2008 DOD CMP*, p. 45.

⁷⁶ *2008 DOD CMP*, p. 5.

⁷⁷ *2008 DOD CMP*, p. 47.

Improvements in these areas might be considered as important as the weapon-modernization activities discussed below. Some of these improvements may require several years to fully implement. DOD states that

the PLA is likely to continue to face several problems as reforms are implemented. For example, the PLA itself acknowledges that military training continues to suffer from units “going through the motions,” heavy scripting, and a lack of realism. The PLA will need to address these deficiencies if the human capital reforms are to achieve any longterm improvements across the military.⁷⁸

Another set of observers states that:

The PLAN’s focus on technological developments notwithstanding, Chinese planners realize that rapid improvements in hardware will not be fully effective without corresponding increases in the ability of military personnel to operate them under realistic combat conditions. In keeping with recent PLA-wide guidance from the General Staff Department that stresses making training more realistic and challenging, the PLAN has emphasized making training approximate the actual battlefield environment as much as possible. Official sources indicate that the PLAN is striving to make training more rigorous.⁷⁹

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 systems;
- 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

⁷⁸ 2008 DOD CMP, p. 48.

⁷⁹ Andrew S. Erickson and Michael S. Chase, “PLA Navy Modernization: Preparing for ‘Informatized’ War at Sea,” *China Brief*, February 29, 2008: 4.

- shipbuilding dependence on foreign suppliers.

The paragraphs below elaborate on these items.

In General. Regarding weaknesses and limitations of China's military in general, a 2007 report by a task force sponsored by the Council on Foreign Relations stated that despite advances,

the PLA confronts many obstacles:

- The sophistication of new equipment generally exceeds current joint command-and-control capabilities.
- Its reliance on a blend of obsolete and modern equipment makes effective large-scale planning, training, and operations difficult.
- Its dependence on multiple foreign arms suppliers makes it hard to build efficient supply chains and maintenance regimes.
- It has a shortage of technically knowledgeable, innovative, initiative-taking personnel who can operate high-tech systems, a deficiency exacerbated by China's lack of a professional corps of noncommissioned officers.
- It has little combat experience — Chinese military forces have not been involved in major combat since 1979, when they performed poorly against Vietnamese forces.
- It lacks many of the instruments of force projection, including long-range bombers, aircraft carriers, large airborne units, and the logistics capability to support and sustain combat forces beyond its borders.

None of these obstacles can be overcome swiftly, and none can be overcome merely by throwing more money at the problem.⁸⁰

DOD states that “the PLA has only a limited capacity to communicate with submarines at sea and the PLA Navy has no experience in managing an SSBN fleet that performs strategic patrols.”⁸¹

Sustained Operations in Distant Waters. Regarding sustained operations in more distant waters, DOD states, “China's ability to sustain military power at a distance remains limited....”⁸² DOD also states that “China will not be able to project and sustain small military units far beyond China before 2015, and will not be able

⁸⁰ Council on Foreign Relations, *U.S.-China Relations: An Affirmative Agenda, A Responsible Course*, Report of an Independent Task Force sponsored by the Council on Foreign Relations, Washington, 2007, p. 47.

⁸¹ 2008 DOD CMP, p. 25.

⁸² 2008 DOD CMP, p. I (Executive Summary).

to project and sustain large forces in combat operations far from China until well into the following decade.”⁸³ DOD further states that:

Over the last decade, the PLA has improved its capability to support operations within its borders and along its periphery....

The absence of a true expeditionary logistics capability, however, will limit the PLA’s ability to project and sustain military operations at distances from the mainland. First among these is the capability to transport and sustain more than a division of ground troops and equipment by sea or air. The PLA Navy’s total amphibious lift capacity has been estimated to be one infantry division of approximately 10,000 troops and equipment at one time. Likewise if all the large transport aircraft in the PLAAF were operational and rigged for parachute drop, only approximately 5,000 parachutists could be delivered in a single lift, much less if equipment is carried at the same time. PLA in-flight refueling capability is limited and can only support small numbers of fighter aircraft. The PLA Navy has gained some proficiency with underway replenishment and sustainment of long distance deployments, but this capability remains limited by the small numbers of support ships.

The PLA’s force projection capabilities will remain limited over the next decade as the PLA replaces outdated aircraft and maritime vessels and adjusts operational doctrine to encompass new capabilities. These changes will require tailored logistics equipment and training which will take time and money to develop proficiency. Although foreign produced equipment and maintenance parts, as well as the civil sector, may help to fill near-term gaps, continued reliance on non-organic assets will hinder PLA capabilities to sustain large-scale operations over time.⁸⁴

Joint Operations. Regarding joint operations, DOD states:

The PLA hopes eventually to fuse service-level capabilities with an integrated network for C4ISR, a new command structure, and a joint logistics system. However, it continues to face deficiencies in inter-service cooperation and actual experience in joint exercises and combat operations.⁸⁵

C4ISR Systems. Regarding C4ISR systems, one set of observers states:

Enhancing China’s naval capabilities is a key component of China’s military transformation, as reflected by recent leadership statements and the development of several new classes of surface ships and submarines. Moreover, informatization is clearly a central aspect of PLAN modernization and naval C4ISR modernization will have important implications in areas such as joint operations and command and control. Chinese C4ISR modernization has become a top priority and PLAN informatization appears to have made some impressive progress in recent years. It remains unclear, however, how close the Chinese actually are to achieving the so-called “informatized force.” The PRC’s 2006 Defense White Paper established a goal of being able to fight and win

⁸³ 2008 DOD CMP, p. 22.

⁸⁴ 2008 DOD CMP, p. 36.

⁸⁵ 2008 DOD CMP, p. 22.

informatized wars by the mid-21st century. This reflects a perceived gap between the Chinese armed forces and the world's most advanced militaries, which Chinese writers often suggest will take decades to overcome. At the same time, however, it also raises the issue of distinguishing between the "ideal" capability the Chinese navy seeks to establish in the long term and that which might simply prove "good enough" in the short term. Indeed, even a relatively simple system of deconfliction⁸⁶ by time or geographic area might be sufficient in a Taiwan scenario. This suggests that the PLAN might achieve an employable capability with surprising rapidity, especially if it pursues one that falls short of the standards set by U.S. proponents of "network centric warfare," but that is nonetheless capable of contributing to the achievement of China's operational and strategic objectives.⁸⁷

Shipbuilding Dependence on Foreign Suppliers. The rapid growth and modernization of China's commercial shipbuilding sector is viewed by observers as benefitting China's warship design and construction programs in certain respects, particularly since China's warships are built in shipyards that also build commercial ships. Improvements in Chinese commercial shipbuilding notwithstanding, observers believe that China's ability to design, build, and maintain complex warships is limited in certain respects by a dependence on foreign suppliers for certain key warship components, particularly propulsion systems and combat system equipment.

DOD states that while "shipyard modernization and expansion has increased China's overall shipbuilding capacity and capabilities, generating corresponding benefits for all types of naval projects, including submarines; surface combatants; naval aviation, including initiatives for aircraft carriers; and amphibious/sealift-airlift assets," China's naval industry "continues to rely on foreign suppliers for some propulsion units and, to a lesser degree, fire control systems, cruise missiles, ship-to-air missiles, torpedo systems, sensors, and other advanced electronics."⁸⁸

One set of observers states that:

Viewed holistically, the cumulative effects of China's improved commercial shipbuilding abilities have undoubtedly benefited [sic] China's naval development to some degree. Military shipbuilding may benefit from advances in hull construction, modular shipbuilding, subcomponent industry improvement, increased yard capacity, and other areas...

China's major shipbuilding facilities have, or are in the process of adopting the latest hull block construction and advanced outfitting ship production methods. These modern techniques use an assembly line approach to shipbuilding, allowing for greater overall throughput capacity and productivity....

⁸⁶ Deconfliction means a process for ensuring that the military units on the same side of a conflict do not get in each other's way or otherwise interfere with one another's operations.

⁸⁷ Andrew S. Erickson and Michael S. Chase, "PLA Navy Modernization: Preparing for 'Informatized' War at Sea," *China Brief*, February 29, 2008: 4-5.

⁸⁸ 2008 DOD CMP, p. 37.

In general, these more efficient production methods have the potential to yield similar beneficial effects on military shipbuilding: reduced build times, increased shipyard output, and lower individual unit cost. Yet perhaps not surprisingly, the most modern tier of shipyards in the PRC thus far has been dedicated to producing commercial ships for the world market....

As a result, under current geo-political conditions, the efficiency gains achieved through advanced production methods and shipyard facilities are more likely to help China achieve a larger share of the global commercial shipbuilding market than play a dominant role in PLAN modernization efforts. Yet if the global strategic situation changed into something more akin to a “Cold War” environment, the PRC leadership could always forego the commercial advantages of these new facilities for the sake of national security needs....

Advanced shipyards and production process alone do not guarantee the ability to build complex ship types. Efficiently integrating numerous mechanical, electrical, cargo, and habitability systems within the confined space of a ship has always been a principal challenge for naval architects and shipbuilders, and is often the greatest challenge in the construction of complex warships....

The dry bulk carriers and oil tankers that have thus far dominated Chinese commercial shipbuilding are relatively low in complexity, and offer little-to-no potential for a carry-over affect on improving systems integration capabilities in military shipbuilding.

The same cannot be said of the considerably more complex 150,000-deadweight-tonne floating (oil) production, offloading and storage (FPSO) vessel recently built by Shanghai Waigaoqiao Shipbuilding, or the liquefied natural gas (LNG) tankers currently under construction at Hudong-Zhonghua Shipbuilding in Shanghai. The sophisticated cargo processing and storage equipment on these vessels are at the high-end of the complexity spectrum for commercial ships, and exceeds that of most naval auxiliaries.

The progress in systems integration proficiency shown by Chinese shipbuilders on these projects is somewhat tempered when considering the level of foreign technical assistance required....

In the naval sector, the outward complexity of the Luyang II air-defense destroyer and other recent PLAN additions seem to indicate a growing trend of improving systems integration capabilities. The Luyang II-class is equipped with the PLAN’s first phased array radar, the cornerstone of a combat system that also includes indigenous HQ-9 surface-to-air missiles and a 48-cell vertical launch system (VLS). The integration of these three subsystems into a comprehensive long-range, area air-defense system is a notable achievement, and may indicate a move towards improved PLAN blue water capability. While this may be the case, little is currently known as to the actual capabilities or operational effectiveness of the Luyang II’s systems, and one might plausibly interpret the purchase of advanced Sovremenny-class destroyers and Kilo-class submarines from Russia as indicators of continued limitations in indigenous capabilities for integrating the most complex sets of warship systems....

The present state of the commercial marine equipment industry is one of notable concern for Chinese officials. Overall, only 40 percent of

sub-components on Chinese-built commercial ships are from indigenous suppliers....

There is little doubt that the problems in China's marine equipment industry have affected PLAN modernization efforts in ways similar to the commercial shipbuilding sector. China has long relied on foreign-made, licensed, or reverse-engineered technology for major weapon systems, and despite notable advances in indigenous combat systems in its latest classes, still uses a high degree of imported combat systems equipment in most PLAN vessels.... This reliance on foreign sub-components, whether in combat systems or less-glamorous commercial dual-use items, extends beyond national self-reliance concerns. Foreign outsourcing drives up acquisition and lifecycle maintenance costs, increases system integration challenges, and places additional demands on crew training. Chinese literature includes accounts of sailors physically tracing out systems hand-over-hand on new Kilo-class submarines due to a lack of technical documentation, as well as accounts of flying in German technicians to repair imported MTU diesel engines on the Type 052-class destroyer Qingdao during the PLAN's first round-the-world cruise in 2002.

These examples illustrate the detrimental effect imported technology can have on operational readiness, and likewise highlight how China's ability to meet its goals of improving its domestic marine equipment industry stands to significantly affect both commercial and military shipbuilding development....

Overwhelmingly, PRC shipbuilders have relied on imported technology for diesel propulsion.... Western shipowners interviewed by the authors indicate that Chinese-made engines are acceptable, but are still inferior to Japanese and Koreanmade marine diesels.

The vast majority of Chinese-built commercial diesel engines remain licensed copies of foreign (principally European) designs.... Chinese engine builders reportedly still experience difficulties manufacturing and mating engine blocks and crankshafts on large marine diesels, and foreign licensing companies frequently provide close technical assistance and quality control oversight to Chinese factories building their most advanced engine models.

The proportion of Chinese indigenous technology is similarly low in naval propulsion.... [There is a] high proportion of diesel propulsion in Chinese ships and submarines built since 1999, and the small percentage of indigenous Chinese engines. German MTU diesel designs are used on Song-class submarines, Luhai and Luyang I/II-class destroyers, and may also be included in China's latest Type 071 Yuzhao-class amphibious ships. Likewise, French-designed SEMT-Pielstick diesels provide the main propulsion for Jiangkai, Jiangnan, and Jianghu-class frigates, Houjian-class patrol craft (PTGs), and eight additional classes of PLAN landing and auxiliary ships.

Marine gas turbines, as with diesel design, have not been a bright spot in Chinese industry. Their development has been severely hindered by the slow pace of indigenous jet engine development, which is symptomatic of larger issues within the Chinese aerospace industry as a whole. Progress in turbofan (vice older turbojet) technology has been particularly slow, thus affecting the high-performance aircraft and marine gas turbine applications that use these more modern and efficient engines. Consequently, no indigenous marine gas turbine has been fielded to date, and the few PLAN units using gas turbine

propulsion relied on imported U.S. engines prior to 1989 (Tiananmen Square trade sanctions), and Ukrainian engines ever since.

The short term prospects for Chinese marine gas turbines directly affecting PLAN modernization are low, but there are indicators of possible improvements in the longer term. Jet engine development is a high priority within the PLA, and the recently introduced J-10 and J-11 fighters are expected to be powered by an indigenous W-10A turbofan engine. The original W-10 and other earlier Chinese turbofans were less than successful, but the W-10A reportedly benefits technologically from Lykulka-Saturn AL-31F turbofans imported from Russia to power the Su-27, Su-30, and earlier J-10 aircraft. Furthermore, the Shenyang Engine Research Institute developed China's first indigenous aero-derivative gas turbine in 2002 (the QD-128, derived from the Kunlun jet engine), and Chinese companies are actively pursuing development of larger aero-derivative gas turbines for electrical power generation and other industrial applications. Success with the W-10A turbofan and these aero-derivative initiatives could provide a significant boost to Chinese marine gas turbine development, and help fill the persistent void in indigenous propulsion technology that has thus far hampered naval modernization.⁸⁹

A separate set of observers stated in 2005 that that:

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.⁹⁰

⁸⁹ Michael C. Grubb and Gabriel Collins, "Chinese Shipbuilding[:] Growing Fast, But How Good Is It" *U.S. Naval Institute Proceedings*, March 2008: 44-51. Quoted passages are from pages 45-50.

⁹⁰ Evan S. Medeiros et al., *A New Direction for China's Defense Industry*. Santa Monica, CA, RAND Corporation, 2005. Pp. 110-111. (MG-334, RAND Project Air Force.) (Hereafter cited as *2005 RAND report*.) 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 stated in 2005 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.⁹¹

Regarding the combat system equipment on China's new destroyers, one observer stated in 2004:

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

⁹¹ 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.

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.⁹²

Anti-Air Warfare (AAW). Regarding AAW, one observer stated in 2004 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 anti-air "point defense" system, giving them some measure of self-defense.... The PLAN surface fleet, however, still lacks "modern air surveillance systems and data links

⁹² James C. Bussert, "China Builds Destroyers Around Imported Technology," *Signal*, August 2004, p. 67.

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.”⁹³

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 been 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.⁹⁴

Antisubmarine Warfare (ASW). Regarding ASW, one set of observers, based on a review of Chinese military literature, states that:

When considering Chinese views of the American submarine force, it is certainly relevant to consider how China appraises its own antisubmarine warfare forces. Generally, China considers its ASW forces to be weak. One Chinese naval analyst observes: “[Chinese] people are focused on China’s submarine force (both conventional and nuclear) development, but often neglect the threat we face from [U.S. Navy] submarines.” It is, moreover, suggested that “there is still a relatively large gap between [China’s] ASW technology level and that of the world’s advanced level.” In appraising the ASW capabilities of its own surface forces, another naval analyst notes, “Across the world, most naval ships are now equipped with towed array sonars, which has increased their ASW capabilities, but most of our ships only have hull mounted sonars.” Finally, there is a concern that these antisubmarine assets are themselves highly vulnerable: “Submarines can carry out ferocious missile attacks from tens or even 100 — 200km ranges, causing the submarine hunting vessels to become the hunted targets.”

Chinese aerial ASW is also highlighted as a particular weakness.⁹⁵

Mine Countermeasures (MCM). Regarding MCM, one observer stated in 2004 that a

⁹³ 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).

⁹⁴ Dominic DeScisciolo, “Red Aegis,” *U.S. Naval Institute Proceedings*, July 2004, pp. 56-58.

⁹⁵ Gabriel Collins, Andrew Erickson, Lyle Goldstein, and William Murray, “Chinese Evaluations of the U.S. Navy Submarine Force,” *Naval College War Review*, Winter 2008: 78-79.

serious [PLA Navy] operational deficiency involves the mine countermeasures vessels (MCMV). Though China has an intense shipping [activity] 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.⁹⁶

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 said three times that the effort will emphasize the navy, air force, and the ballistic missile force.⁹⁷ China's 2006 defense white paper stated: "Through restructuring, the proportion of the Navy, Air Force and Second Artillery Force in the PLA has been raised by 3.8 percent while that of the Army has been lowered by 1.5 percent."⁹⁸ The 2006 white paper further stated:

The Navy aims at gradual extension of the strategic depth for offshore defensive operations and enhancing its capabilities in integrated maritime operations and nuclear counterattacks....

The Navy and Air Force have cut some ship groups and aviation divisions, regiments and stations, and set up some high-tech surface ship, aviation and ground-to-air missile units....

The Navy is working to build itself into a modern maritime force of operation consisting of combined arms with both nuclear and conventional means of operations. Taking informationization as the goal and strategic focus

⁹⁶ Massimo Annati, "China's PLA Navy, The Revolution," *Naval Forces*, No. 6, 2004, p. 73.

⁹⁷ The white paper stated:

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 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.)

⁹⁸ *2006 China White Paper*, paragraph entitled "Downsizing the PLA."

in its modernization drive, the Navy gives high priority to the development of maritime information systems, and new-generation weaponry and equipment. Efforts are being made to improve maritime battlefield capabilities, with emphasis on the construction of relevant facilities for new equipment and the development of combat support capabilities. The Navy is endeavoring to build mobile maritime troops capable of conducting operations under conditions of informationization, and strengthen its overall capabilities of operations in coastal waters, joint operations and integrated maritime support. Efforts are being made to improve and reform training programs and methods to intensify training in joint integrated maritime operations. The Navy is enhancing research into the theory of naval operations and exploring the strategy and tactics of maritime people's war under modern conditions.⁹⁹

The heads of 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.¹⁰⁰ Regarding this development, a 2007 report from the Office of Naval Intelligence stated:

In September 2004, the commander of the PLAN, Admiral Zhang Dingfa, became the first PLAN commander ever to serve concurrently as a member of the CCP Central Committee's Military Commission (CMC). His promotion in grade and appointment to the CMC provided a unique challenge for the PLAN within the PLA hierarchy.

[A]ll organizations within the PLA are assigned one of 15 grades. In addition, the commander and political officer are assigned the same grade. However, when Zhang Dingfa was promoted one grade as a CMC member, neither the grade for the PLAN as an organization nor the grade of the PLAN political commissar was raised to the same level. Therefore, although Zhang and his successors will hold the same grade as the Chief of the General Staff and the directors of the General Political Department (GPD), General Logistics Department (GLD), and General Equipment Department (GED), the PLAN as an organization is not equal to the four General Departments and is still at the same grade as the seven Military Regions.¹⁰¹

Another set of observers states:

In recent years, senior Chinese Communist Party (CCP) leaders and high-ranking military officers have repeatedly emphasized the importance of naval modernization. Most prominently, CCP General Secretary, President and Central Military Commission (CMC) Chairman Hu Jintao in a December 2006 speech to People's Liberation Army Navy (PLAN) officers underscored the need "to build a powerful People's navy that can adapt to its historical mission during a new century and a new period" (International Herald Tribune, December 26, 2006). Similarly, PLAN Commander Wu Shengli and Political Commissar Hu

⁹⁹ *2006 China White Paper*, paragraphs entitled "Implementing the military strategy of active defense," and "Improving the structure of services and arms," and a paragraph in the section entitled "Development of the Services and Arms."

¹⁰⁰ See, for example, *2005 DOD CMP*, p. 1.

¹⁰¹ U.S. Department of the Navy, Office of Naval Intelligence, *China's Navy 2007*, Washington, 2007. p. 11.

Yanlin promoted the importance of naval modernization in an article that appeared in the authoritative CCP journal Seeking Truth. This growing sense of urgency about naval modernization appears to be a function of increasing concern about maritime security issues, particularly Taiwan, the protection of maritime resources and energy security.¹⁰²

Another observer states:

If there had been any doubts about China's plans to develop into a major naval power, they were dispelled by President Hu Jintao on 27 December 2006. In his speech to representatives of the navy's 10th national Communist Party congress in Beijing he said "in the process of protecting the nation's authority and security and maintaining our maritime rights, the navy's role is very important." He called on military commanders to build a "powerful people's navy that can adapt to its historical mission during a new century and a new period," while adding that the Navy should be ready to protect the country's interests "at any time." Two years after the promotion of the Commander-in-Chief, Admiral Zhang Dingfa, to a full seat on the Central Military Commission, the navy's evolution from being a coastal force to one that is at the centre of Chinese strategy is now assured.¹⁰³

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

- **limited force or "No War" options**, in which "China might use a variety of lethal, punitive, or disruptive military actions in a limited campaign against Taiwan, likely in conjunction with overt and clandestine economic and political activities. Such a campaign could include CNA [computer network attack] against Taiwan's political, military, and economic infrastructure to target the Taiwan people's confidence in their leadership. Similarly, PLA special operations forces infiltrated into Taiwan could conduct economic, political, or military sabotage or attacks against leadership targets";
- **an air and missile campaign**, in which "Limited SRBM attacks and precision strikes against air defense systems, including air bases, radar sites, missiles, space assets, and communications facilities could support a campaign to degrade Taiwan's defenses, neutralize Taiwan's military and political leadership, and possibly break the Taiwan people's will to fight";
- **a maritime quarantine or blockade**, in which "Beijing could declare that ships en route to Taiwan ports must stop in mainland ports for safety inspections prior to transiting on to Taiwan. It could

¹⁰² Andrew S. Erickson and Michael S. Chase, "PLA Navy Modernization: Preparing for 'Informatized' War at Sea," *China Brief*, February 29, 2008: 2.

¹⁰³ *Jane's Fighting Ships 2007-2008*, pp. 30-31 (Executive Overview).

also attempt the equivalent of a blockade by declaring exercise or missile closure areas in approaches to ports with the effect of closing port access and diverting merchant traffic — as occurred during the 1995-96 missile firings and live-fire exercises”; and

- **an amphibious invasion**, about which DOD states that “China’s Joint Island Landing Campaign envisions a complex operation relying on interlocking, supporting, subordinate campaigns for logistics, electronic warfare, and air and naval support — all coordinated in space and time — to break through or circumvent shore defenses, establish and build a beachhead, transport personnel and materiel to designated landing sites, and then launch an attack to split, seize, and occupy key targets and/or the entire island.”¹⁰⁴

Regarding the option of a maritime quarantine or blockade, DOD states further that:

Although a traditional maritime quarantine or blockade would have greater impact on Taiwan, it would also tax PLA Navy capabilities. PLA doctrinal writings describe potential lower cost solutions: air blockades, missile attacks, and mining or otherwise obstructing harbors and approaches to achieve the desired outcome at lower cost. Chinese elites could underestimate the degree to which any attempt to limit maritime traffic to and from Taiwan would trigger countervailing international pressure and risk military escalation.¹⁰⁵

Regarding the option of an amphibious invasion, DOD states further that:

The PLA currently is capable of accomplishing various amphibious operations short of a full-scale invasion of Taiwan. With few overt military preparations beyond seasonally routine amphibious training, China could launch an invasion of a small Taiwan-held island such as Pratas or Itu Aba. Such a limited invasion of a lightly defended island could demonstrate military capability and political resolve, would achieve tangible territorial gain, and could be portrayed as showing some measure of restraint. However, such an operation includes significant — if not prohibitive — political risk as it could galvanize the Taiwan populace and generate international opposition.

¹⁰⁴ 2008 DOD CMP, pp. 42-43.

¹⁰⁵ 2008 DOD CMP, p. 43. 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 and William Murray as printed in as printed in *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, pp. 132-133, 147-151. See also Michael C. Grubb, “Merchant Shipping In A Chinese Blockade Of Taiwan,” *Naval War College Review*, *Winter 2007*: 81-102.

A PLA invasion of a medium-sized defended offshore island such as Mazu or Jinmen, while within China's capabilities, would involve logistic and military preparation well beyond routine training.

Large-scale amphibious invasion is one of the most complicated and logistics-intensive, and therefore difficult, military maneuvers. Success depends upon air and sea supremacy in the vicinity of the operation, rapid buildup of supplies and sustainment on shore, and an uninterrupted flow of support thereafter. An invasion of Taiwan would strain the capabilities of China's untested armed forces and would almost certainly invite international intervention. These stresses, combined with the combat attrition of China's forces, the complex tasks of urban warfare and counterinsurgency — assuming a successful landing and breakout — make an amphibious invasion of Taiwan a significant political and military risk for China's leaders. Modest targeted investments by Taiwan to harden infrastructure and strengthen defensive capabilities could have measurable effects on decreasing Beijing's ability to achieve its objectives.¹⁰⁶

Anti-Access Force for Short-Duration Conflict. More specifically, some observers believe that China's military modernization is aimed at fielding a force that can succeed in a short-duration conflict. Consistent with this goal, some 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. naval and air forces. DOD states that:

Some analysts hold that Beijing first would pursue a measured, judicious, and deliberate approach characterized by signaling its readiness to use force in an attempt to coerce Taiwan, followed by a deliberate buildup of force, which would optimize speed of engagement over strategic deception. Others assess that the more likely course of action would be for China to sacrifice deliberate preparations in favor of strategic surprise to force a rapid military and/or political resolution before the United States or other countries could respond. If a quick resolution is not possible, Beijing would seek to deter potential U.S. intervention; or, failing that, delay such intervention, seek to defeat it in an asymmetric, limited, or quick war, or fight to a standstill and pursue a political settlement after a protracted conflict.¹⁰⁷

DOD also states that:

As part of its planning for a Taiwan contingency, China is prioritizing measures to deter or counter third-party intervention in any future cross-Strait crisis. China's approach to dealing with this challenge centers on what DoD's 2006 *Quadrennial Defense Review* refers to as "disruptive capabilities": forces and operational concepts aimed at deterring or denying the entry of enemy forces into a theater of operations (anti-access), and limited duration denial of enemy freedom of action in a theater of operations (area denial). In this context, the PLA appears engaged in a sustained effort to develop the capability to interdict or attack, at long ranges, military forces — particularly air or maritime forces —

¹⁰⁶ 2008 DOD CMP, p. 43-44.

¹⁰⁷ 2008 DOD CMP, pp. 41-42.

that might deploy or operate within the western Pacific. Increasingly, China's anti-access/area denial forces overlap, providing multiple layers of offensive systems, utilizing the sea, air, space, and cyber-space.

PLA planners are focused on targeting surface ships at long ranges from China's shores. Analyses of current and projected force structure improvements suggest that China is seeking the capacity to hold surface ships at risk through a layered capability reaching out to the "second island chain" (i.e., the islands extending south and east from Japan, to and beyond Guam in the western Pacific Ocean). One area of investment involves combining conventionally-armed ASBMs based on the CSS-5 (DF-21) airframe, C4ISR for geo-location and tracking of targets, and onboard guidance systems for terminal homing to strike surface ships on the high seas or their onshore support infrastructure. This capability would have particular significance, as it would provide China with preemptive and coercive options in a regional crisis.

PRC military analysts have also concluded that logistics and mobilization are potential vulnerabilities in modern warfare, given the requirements for precision in coordinating transportation, communications, and logistics networks. To threaten regional bases and logistics points, China could employ SRBM/MRBMs, land-attack cruise missiles, special operations forces, and computer network attack (CNA). Strike aircraft, when enabled by aerial refueling, could engage distant targets using air-launched cruise missiles equipped with a variety of terminal-homing warheads.

China's emerging local sea denial capabilities — mines, submarines, maritime strike aircraft, and modern surface combatants equipped with advanced ASCMs — provide a supporting layer of defense for its long-range anti-access systems. Acquisition and development of the KILO, SONG, SHANG, and YUAN-class submarines illustrates the importance the PLA places on undersea warfare for sea denial. In the past ten years, China has deployed ten new classes of ships. The purchase of SOVREMENNYI II-class DDGs and indigenous production of the LUYANG I/ LUYANG II DDGs equipped with long-range ASCM and SAM systems, for example, demonstrate a continuing emphasis on improving anti-surface warfare, combined with mobile, wide-area air control.

The air and air defense component of anti-access/area-denial includes SAMs such as the HQ-9, SA-10, SA-20 (which has a reported limited ballistic and cruise missile defense capability), and the extended-range SA-20 PMU2. Beijing will also use Russian-built and domestic fourth-generation aircraft (e.g., Su-27 and Su-30 variants, and the indigenous F-10 multirole fighter). The PLA Navy would employ Russian Su-30MK2 fighters, armed with AS-17/Kh-31A anti-ship missiles. Acquisition of an air refueling platform like the Russian IL-78 would extend operational ranges for PLAAF and PLA Navy strike aircraft armed with precision munitions, thereby increasing the threat to surface and air forces, bases, and logistics nodes distant from China's coast. Additionally, acquisition and development of longer-range unmanned aerial vehicles (UAVs) and unmanned combat aerial vehicles (UCAVs), including the Israeli HARPY, expands China's options for long-range reconnaissance and strike.¹⁰⁸

¹⁰⁸ 2008 DOD CMP, pp. 22-23.

Regarding the potential time line for a short-duration conflict with Taiwan, one observer stated in 2005 that:

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.¹⁰⁹

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 it has attained) a capable maritime anti-access capability, or important elements of it, by about 2010.¹¹⁰ Other observers believe China will attain (or believe that it has attained)

¹⁰⁹ 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.

¹¹⁰ One observer stated in 2006 that:

By 2008, China will have the capability to credibly conduct short-term sea denial operations out to about 400 nautical miles from its coastline; and by 2010 may be able to sustain such operations for a few weeks. Obviously, this capability does not accrue to the Straits of Malacca and the Indian Ocean — China can at best hope to "show the flag" for coercive and/or defensive purposes in those waters until after 2015.

(Statement of Cortez A. Cooper III for a March 16, 2006, hearing before the U.S.-China Economic and Security Review Commission, p.3.)

This observer also stated:

Looking at a net assessment of emerging Chinese capabilities and U.S. power projection in the Pacific theater, there is a window of concern between roughly 2008 and 2015. Many Chinese programs focused on Taiwan and the near periphery (new cruise and maneuverable ballistic missiles, submarines, and destroyers) will be fully online around 2008; but some of the US capabilities to defeat China's sea denial strategy (missile defenses, littoral strike assets, a state-of-the-art, integrated ASW network) may not be in place until around the middle of the next decade.

(Ibid., p. 8.)

Another observer stated in 2005:

Because the Chinese submarine fleet will operate in nearby waters and in the

such a capability some time after 2010. DOD states that: “The U.S. Intelligence Community estimates China will take until the end of this decade or longer to produce a modern force capable of defeating a moderate-size adversary.”¹¹¹ 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 Goals. In addition to the near-term focus on developing military options for addressing the situation with Taiwan, DOD and some 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 from the region;
- **defending China’s claims in maritime territorial disputes**, some of which have implications for oil, gas, or mineral exploration rights;¹¹² and
- **protecting China’s sea lines of communication**, which China relies upon increasingly for oil and other imports.

Such broader or longer-term goals would be potentially significant for at least three reasons. First, they imply that if the situation with Taiwan were somehow

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. (Prepared statement of John J. Tkacik, Jr., for a July 27, 2005, hearing before the House Armed Services Committee, p. 8.)

See also the prepared statement of Richard D. Fisher, Jr., for a July 27, 2005, hearing before the House Armed Services Committee, 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 *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, p. 85, which stated, “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.

¹¹¹ 2008 DOD CMP, p. 22.

¹¹² For more on this topic, see CRS Report RL31183, *China’s Maritime Territorial Claims: Implications for U.S. Interests*, Kerry Dumbaugh, coordinator. See also Chris Johnson, “Analysts Discuss Maritime Implications of China’s Energy Strategy,” *Inside the Navy*, December 18, 2006.

resolved, China could find continuing reasons to pursue its naval modernization effort.

Second, they would imply that if China completes its planned buildup of Taiwan-related naval force elements, or if the situation with Taiwan were somehow resolved, the composition of China's naval modernization effort could shift to include a greater emphasis on naval force elements that would be appropriate for supporting these broader or longer-term interests, such as aircraft carriers, a larger number of nuclear-powered attack submarines, serial production of destroyers, underway replenishment ships, and overseas bases or support facilities.

Third, such broader or longer-term goals would suggest that even if China's military were never to engage in combat with an opposing military, China's military forces, including in particular its naval forces, could still be used on a day-to-day basis to promote China's political position in the Pacific. This would create an essentially political (as opposed to combat-related) reason for the United States or other countries to maintain a competitive presence in the region with naval and other forces that are viewed by observers in the Pacific as capable of effectively countering China's forces.

DOD states that:

China's near-term focus on preparing for contingencies in the Taiwan Strait, including the possibility of U.S. intervention, is an important driver of its modernization. However, analysis of China's military acquisitions and strategic thinking suggests Beijing is also developing capabilities for use in other contingencies, such as conflict over resources or disputed territories.¹¹³

DOD also states that:

China's military appears focused on assuring the capability to prevent Taiwan independence and, if Beijing were to decide to adopt such an approach, to compel the island to negotiate a settlement on Beijing's terms. At the same time, China is laying the foundation for a force able to accomplish broader regional and global objectives.¹¹⁴

In January 2007, the Director of National Intelligence stated:

Beijing continues its rapid rate of military modernization, initiated in 1999. We assess that China's aspirations for great power status, threat perceptions, and security strategy would drive this modernization effort even if the Taiwan problem were resolved.¹¹⁵

Regarding China's economic interests, DOD states that:

¹¹³ 2008 DOD CMP, p. I (Executive Summary).

¹¹⁴ 2008 DOD CMP, p. 22.

¹¹⁵ Annual Threat Assessment of the Director of National Intelligence, January 11, 2007, John D. Negroponte, Director of National Intelligence, p. 10.

As China's economy grows, dependence on secure access to markets and natural resources, particularly metals and fossil fuels, is becoming a more significant factor shaping China's strategic behavior....

China currently consumes approximately 7.58 million barrels of oil per day and, since 2003, has been the world's third largest importer of oil and second largest consumer, after the United States. China currently imports over 53 percent of its oil (around 4.04 million barrels per day in the first three quarters of 2007), with the vast majority coming by ship and transiting through the Malacca or Lombok/Makassar Straits. By 2015, China's oil consumption will rise to 10-12 million barrels per day. China is also working with Russia to develop the East Siberia-Pacific Ocean oil pipeline, with a 1.6 million barrels per day capacity, to ensure China's continued access to Russian oil and reduce dependence on sea-borne shipping for oil imports....

The extent to which Beijing's concerns over the security of its access to energy supplies shapes China's defense policy and force planning is not known. However, it is apparent that these concerns influence China's thinking about the problems of defense planning. China's 2006 defense white paper states explicitly in its description of the security environment that "security issues related to energy, resources, finance, information and international shipping routes are mounting." It also defines the PLA's primary tasks as "upholding national security and unity, and ensuring the interests of national development."

The PLA appears to be debating how to translate these tasks into doctrinal evolution, resource allocations, force structure changes, and contingency planning. However, as China's current ability to project and sustain power at a distance remains limited, the PLA, at least for the near and mid-terms, will face an ambition-capability gap. Currently it is neither capable of using military power to secure its foreign energy investments nor of defending critical sea lanes against disruption.

Looking to the future, China's leaders may seek to close this gap by developing: extended-range power projection, including aircraft carrier development; expeditionary warfare; undersea warfare; anti-air warfare; long-range precision strike; maritime C4ISR; expeditionary logistics and forward basing; training and exercises, especially in open water; and a more activist military presence abroad.¹¹⁶

Regarding territorial disputes, DOD states that:

Since 1998, China has settled eleven territorial disputes with six of its neighbors. However, disputes continue over exclusive economic zones (EEZ) and ownership of potentially rich oil and gas deposits, including some 7 trillion cubic feet of natural gas and up to 100 billion barrels of oil in the East China Sea, which has contributed to friction with Japan. Japan maintains that an equidistant line should separate the EEZs, while China claims an Extended Continental Shelf beyond the equidistant line to the Okinawa Trench — extending almost to Japan's shore. In the South China Sea, China claims exclusive sovereignty over the Spratly and Paracel island groups — claims disputed by Brunei, the Philippines, Malaysia, Taiwan, and Vietnam. In December 2007, China

¹¹⁶ 2008 DOD CMP, pp. 10, 12-13.

announced the establishment of “Sansha City” to assert “indisputable sovereignty” and jurisdiction over the islands of the South China Sea “and the adjacent waterways.”

The South China Sea plays an important role in Northeast Asian security considerations. Over 80 percent of crude oil supplies to Japan, South Korea, and Taiwan flow through the South China Sea — making these countries especially dependant on South China Sea shipping routes. In 2007, Vietnam reported repeated incidents with the PLA Navy in the waters near the Spratly Islands. In April, Vietnam’s coast guard reported that PLA Navy vessels had captured four Vietnamese fishing boats, detaining and fining 41 fishermen; and, in July, a PLA Navy ship fired on Vietnamese fishing vessels, reportedly sinking one ship, killing a fisherman, and injuring several others.¹¹⁷

Regarding investments relating to broader or longer-term goals, DOD states that:

China continues to invest in military programs designed to improve extended-range power projection. Current trends in China’s military capabilities are a major factor in changing East Asian military balances, and could provide China with a force capable of prosecuting a range of military operations in Asia — well beyond Taiwan. Given the apparent absence of direct threats from other nations, the purposes to which China’s current and future military power will be applied remain unknown. These capabilities will increase Beijing’s options for military coercion to press diplomatic advantage, advance interests, or resolve disputes in its favor.

Official documents and the writings of PLA military strategists suggest Beijing is increasingly surveying the strategic landscape beyond Taiwan. Some PLA analysts have explored the geopolitical value of Taiwan in extending China’s maritime “defensive” perimeter and improving its ability to influence regional sea lines of communication....

Analysis of China’s weapons acquisitions also suggests China is looking beyond Taiwan as it builds its force. For example, new missile units outfitted with conventional theater-range missiles at various locations in China could be used in a variety of non-Taiwan contingencies. AEW&C and aerial-refueling programs would permit extended air operations into the South China Sea and beyond.

Advanced destroyers and submarines reflect Beijing’s desire to protect and advance its maritime interests up to and beyond the second island chain. Potential expeditionary forces (three airborne divisions, two amphibious infantry divisions, two marine brigades, about seven special operations groups, and one regimental-size reconnaissance element in the Second Artillery) are improving with the introduction of new equipment, better unit-level tactics, and greater coordination of joint operations. Over the long term, improvements in China’s C4ISR, including space-based and over-the-horizon sensors, could enable Beijing

¹¹⁷ 2008 DOD CMP, p. 11.

to identify, track, and target military activities deep into the western Pacific Ocean.¹¹⁸

At a December 13, 2007, hearing before the House Armed Services Committee, Admiral Gary Roughead, the Chief of Naval Operations, was asked by Representative Bartlett, “Why do you think the Chinese are so aggressively pursuing a blue water navy? They don’t need one for Taiwan, do they? Won’t a brown water navy do just fine there?” Admiral Roughead replied:

I believe that what the Chinese navy, the PLA navy, is doing is developing a blue water navy that allows them to influence and control events in the western Pacific, in — around some of the critical straits and into the Indian Ocean. That is the navy they are building. They are very unabashed about the fact that they are building a blue water navy that will operate out to the first island chain, as they refer.

And as we have seen throughout history, and as we have seen in our own country over the course of our nation’s history, that we are a maritime nation and our Navy and Marine Corps and Coast Guard are the maritime forces that can influence events in that maritime domain.

They also see, as do other countries, the importance of navies to assure their security and their prosperity, and that is what is going on. And we, as a Navy, Marine Corps, and Coast Guard, must also value our Navy and what it takes to be a global navy, to be able to influence events in ways that are advantageous to our country.¹¹⁹

A 2007 report by a task force sponsored by the Council on Foreign Relations stated:

China’s military modernization has two main drivers, one with a clear operational objective (Taiwan) and the other with a clear strategic objective (to build a modern military because China will be a modern power).¹²⁰

Another observer states, in discussing China’s 2006 defense white paper, that

While the navy would have a major role in the event of Taiwan operations, it was its wider role that was emphasised. “The Navy aims at gradual extension of the strategic depth for offshore defensive operations and enhancing its capabilities in integrated maritime operations and nuclear counterattacks,” the paper stated, while the need to protect maritime trade, particularly crucial imports of oil and raw materials, was also stressed.¹²¹

¹¹⁸ 2008 DOD CMP, pp. 29-30.

¹¹⁹ Source: Transcript of hearing.

¹²⁰ Council on Foreign Relations, *U.S.-China Relations: An Affirmative Agenda, A Responsible Course*, Report of an Independent Task Force sponsored by the Council on Foreign Relations, Washington, 2007, p. 43.

¹²¹ *Jane’s Fighting Ships 2007-2008*, p. 31 (Executive Overview)

Another observer stated in 2007:

While committed to deterring or defeating Taiwan and thwarting U.S. intervention, the PLAN's focus increasingly represents a more general — and ambitious — goal of attaining the means of projecting power across the sea lines of communication (SLOC) and protecting the ocean commerce on which China's economy relies. Such an objective explains certain aspects of its modernization, such as the aggressive construction of a new class of nuclear attack submarines (SSNs). The successful development of the SSNs would allow the PLAN to deter would-be disrupters of Chinese energy supplies, the majority of which are transported by sea. Moreover, sea-lane security presents a rationale for the development of an aircraft carrier, a type of ship that would serve only as an easy target in a Taiwan scenario — where China's land-based airfields are more than sufficient — but would allow for the Chinese military to project its power across maritime regions far beyond the range of land-based aircraft.

Indeed, these developments indicate that China's senior leaders and strategists are increasingly concerned with traditional and non-traditional threats (e.g. piracy, smuggling, terrorism and other disruptions by non-state actors) to ocean commerce.¹²²

Some PLA Navy units in recent years have been deployed outside China's home waters for purposes other than making diplomatic port calls. In November 2004, for example, a Han-class SSN was detected in Japanese territorial waters near Okinawa.¹²³ DIA states that, as part of the same deployment, this submarine traveled “far into the western Pacific Ocean...”¹²⁴ Press reports state that the submarine operated in the vicinity of Guam before moving toward Okinawa.¹²⁵

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

¹²² Eric A. McVadon, “U.S.-PRC Maritime Cooperation: An Idea Whose Time Has Come,” *China Brief* (Jamestown Foundation), June 13, 2007.

¹²³ 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. See also 2006 DOD CMP, pp. 11-12.

¹²⁴ 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.

¹²⁵ 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.

plane near the Chunxiao gas field, according to the [Japan] Maritime Self-Defense Forces.¹²⁶

Another press report stated:

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.¹²⁷

On October 26, 2006, a Song-class SS reportedly surfaced five miles away from the Japan-homeported U.S. Navy aircraft carrier Kitty Hawk (CV-63), which reportedly was operating at the time with its strike group in international waters in the East China Sea, near Okinawa. According to press reports, the carrier strike group at the time was not actively searching for submarines, and the Song-class boat remained undetected by the strike group until it surfaced and was observed by one of the strike group’s aircraft.¹²⁸ The Chinese government denied that the submarine was following the strike group.¹²⁹

A distance of five miles would be well within the typical defensive perimeter for a carrier strike group. (Such a perimeter might extend tens of miles, or more than 100 miles, from a strike group’s ships.) It would also be within the reported firing

¹²⁶ 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.

¹²⁷ “China Sends Warships to East China Sea,” *DefenseNews.com*, September 29, 2005. *2006 DOD CMP*, p. 2, states that in the Fall of 2005, “PLA Navy vessels trained their weapons on Japanese Self Defense Forces aircraft monitoring Chinese drilling and survey activity in the disputed area.”

¹²⁸ Bill Gertz, “China Sub Secretly Stalked U.S. Fleet,” *Washington Times*, November 13, 2006: 13; Philip Creed, “Navy Confirms Chinese Sub Spotted Near Carrier,” *NavyTimes.com*, November 13, 2006; Bill Gertz, “Defenses On [sic] Subs To Be Reviewed,” *Washington Times*, November 14, 2006; En-Lai Yeoh, “Fallon Confirms Chinese Stalked Carrier,” *NavyTimes.com*, November 14, 2006; Bill Gertz, “Admiral Says Sub Risked A Shootout,” *Washington Times*, November 15, 2006; Jeff Schogol, “Admiral Disputes Report That Kitty Hawk, Chinese Sub Could Have Clashed,” *Mideast Starts and Stripes*, November 17, 2006.

¹²⁹ Associated Press, “China Denies Reports That Sub Followed Kitty Hawk,” *NavyTimes.com*, November 16, 2006. A shorter version of the same story was published as Associated Press, “China Denies Sub Followed A Group Of U.S. Warships,” *Asian Wall Street Journal*, November 17, 2006: 11.

range of certain modern submarine-launched torpedoes, and well within the firing range of submarine-launched ASCMs.

The surfacing of an undetected submarine well within the defensive perimeter of another country's surface naval formation can sometimes be intended as a deterrent action — a warning from the submarine-operating country that submarines like the one in question can penetrate the ASW systems of the other country's surface naval forces. Whether that was the intent behind the Song-class boat's decision to surface is not clear; the boat may have surfaced for other reasons. Since the Kitty Hawk strike group was not actively searching for submarines at the time, the implications of the incident for assessing U.S. ASW capabilities against Song-class submarines are also not clear. U.S. officials reportedly reviewed their ASW defenses in light of the incident.¹³⁰

Regarding base access and support facilities to support more distant PLA Navy operations, one press report in 2005 stated:

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

¹³⁰ Bill Gertz, “Defenses On [sic] Subs To Be Reviewed,” *Washington Times*, November 14, 2006: 1. One observer recounts the incident as follows:

In September 2006, Rear Admiral Ding Yiping, China's top submarine officer and PLAN Vice Chief of Staff, sent a Song submarine on a mission to hunt an American carrier. On October 27 (October 26, Washington time), the submarine surfaced in waters off Okinawa within torpedo range of the U.S.S. Kitty Hawk, where it was seen in the Kitty Hawk's wake by an F-18 pilot on landing approach. It then submerged and disappeared, defeating all U.S. anti-submarine warfare (ASW) efforts to detect it. The carrier battle group's ASW systems did not detect the sub because it had apparently waited — submerged, stationary, and silent — for at least one day as the task force approached the area. Beijing's state-controlled media reported that Admiral Ding had personally commanded the entire operation, perhaps even skippering the submarine himself, and predicted that the success of his mission would lead to a promotion....

The official Chinese press noted the PLA high command's confidence in Admiral Ding — ample evidence of their pleasure at the success the mission against the Kitty Hawk. The Chinese foreign ministry's protest that the vessel had not stalked the Kitty Hawk is likely the literal truth, indicating that the submarine simply waited submerged until the U.S. battle group sailed over it.

(John J. Tkacik, Jr., *China's Quest for a Superpower Military*, Heritage Foundation Backgrounder No. 2036, May 17, 2007, pp. 9 and 10.)

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....¹³¹

¹³¹ 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 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.

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.

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.¹³² 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; and
- 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.

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.

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

¹³² 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.

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.-homeported 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 Western Pacific might require a total of about five San Diego-based cruisers or destroyers.¹³³

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, amphibious ships, and mine warfare ships homeported in Japan, and three attack submarines homeported in Guam. The Navy has also experimented 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.¹³⁴ Navy cruise missile submarines (SSGNs) that are homeported in Bangor, Washington, are to be operated out of Guam with dual crews that each rotate out from Bangor. Each SSGN will be operated by three crews before returning to Bangor.¹³⁵

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.¹³⁶ **Table 5** 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.¹³⁷ U.S. Navy submarines, aircraft

¹³³ For a discussion, see archived CRS Report 92-803, *Naval Forward Deployments and the Size of the Navy*, by Ronald O'Rourke. (Out of print and available directly from the author.)

¹³⁴ For a discussion see CRS Report RS21338, *Navy Ship Deployments: New Approaches — Background and Issues for Congress*, by Ronald O'Rourke.

¹³⁵ Jacob Sippel, "USS Ohio Arrives In Guam For Crew Swap," *Navy News Service*, January 11, 2008; and Oyaol Ngirairiki, "USS Ohio Moors at Bravo Wharf," *Navy News Service*, January 17, 2008.

¹³⁶ 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.

¹³⁷ 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.

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 Littoral Combat Ships (LCSs) are to have a maximum sustained speed of about 45 knots, but their average speed over long transits would likely be less than that.

Table 5. 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,¹³⁸ 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 7 to 12 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 possibility of transferring a carrier from the continental United States to Hawaii or Guam — an option that DOD considered in 2005-2006 but decided against in 2007¹³⁹ — one observer stated in 2005:

¹³⁸ Everett is located on the Puget Sound, about 23 nautical miles north of Seattle.

¹³⁹ DOD decided to home port the carrier in question, the Carl Vinson, at San Diego.

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 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.¹⁴⁰

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.¹⁴¹ One set of observers states:

The operational significance of stationing SSNs on Guam is not lost on Chinese naval analysts. One observes that “if [a submarine] sets out from Guam, especially in a Taiwan Strait crisis, it may only require 2 days or so.” A significant finding of the present study is that even in official journals, Chinese analysts are exploring Guam’s vulnerabilities. The same author notes that Guam, in addition to conferring some advantages to the United States in a Taiwan crisis, also carries self-defense vulnerabilities having strategic implications...

... it is clear that some Chinese analysts perceive Guam to be vulnerable to offensive attacks.¹⁴²

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;

¹⁴⁰ 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*.)

¹⁴¹ For a list of recommended actions for improving the ability of bases in the Western Pacific to defend themselves from PLA attack, see Roger Cliff et al., *Entering the Dragon’s Lair: Chinese Antiaccess Strategies and Their Implications for the United States*. Santa Monica, CA, RAND Corporation, 2007. Pp. 95-101. (MG-524-AF, RAND Project Air Force.)

¹⁴² Gabriel Collins, Andrew Erickson, Lyle Goldstein, and William Murray, “Chinese Evaluations of the U.S. Navy Submarine Force,” *Naval College War Review*, Winter 2008: 72.

- 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.

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

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:

- 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.¹⁴³

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 its planning 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?*

¹⁴³ 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.

Military 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 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 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 since 2005 has implemented several organizational and programmatic initiatives that reflect an interest in increasing the Navy's role in the GWOT.¹⁴⁴ At the same time, the Navy has occasionally affirmed the importance of China's military modernization in its budget planning. A Navy-Marine Corps-Coast Guard maritime strategy document released on October 17, 2007,¹⁴⁵ uses the terms "terrorism," "terrorists," or "terrorist networks" eight times, and the terms "major power war," "major power," and "major combat operations" six times. The document does not mention specific terrorist organizations (such as al Qaeda) or specific foreign countries (such as China, Iran, North Korea, or Russia) by name, perhaps because the authors of the document believed it would be inappropriate to do so in a general strategy document.¹⁴⁶

An October 9, 2007, memorandum on Department of the Navy objectives for FY2008 and beyond presents six major objectives, along with supporting tasks for each objective. The second of the six objectives is "Use the Navy-Marine Corps Team to aggressively prosecute the Global War on Terrorism." None of the other five objectives focuses specifically on preparing for major power conflict, though several of them contain supporting tasks that relate to being prepared for major power conflict. The document does not mention specific terrorist organizations or specific

¹⁴⁴ For further discussion, see CRS Report RS22373, *Navy Role in Global War on Terrorism (GWOT) — Background and Issues for Congress*, by Ronald O'Rourke.

¹⁴⁵ *A Cooperative Strategy for 21st Century Seapower*, October 2007, 18 pp.

¹⁴⁶ The Navy's final Cold War-era strategy document — the mid-1980s Maritime Strategy, also called the Forward Maritime Strategy — referred to the Soviet Union and its military forces, and to certain other named countries, on several occasions. (See James D. Watkins, "The Maritime Strategy," in *The Maritime Strategy*, a supplement to the January 1986 issue of the *U.S. Naval Institute Proceedings*.)

foreign countries by name, perhaps because the authors of the document believed it would be inappropriate to do so in an objectives memorandum.¹⁴⁷

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 March 27, 2008, the Navy included a total of 280 ships of various kinds. The Navy is proposing to achieve and maintain in coming years a fleet of 313 ships.¹⁴⁸ In assessing the adequacy of the 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 conducting less-frequent operations in other parts of the world, such as the Mediterranean Sea, 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 of its various missions, at least not without putting undue stress on Navy personnel and equipment. Navy officials have responded that the proposed 313-ship Navy would be sufficient to perform the Navy's various peacetime and wartime missions.

Pacific Fleet's Share of the Navy. *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 Atlantic Ocean, the Caribbean Sea, and the Mediterranean Sea, while Pacific Fleet ships conduct operations in the Pacific Ocean. Ships from both

¹⁴⁷ Memorandum dated October 9, 2007, entitled "Department of the Navy Objectives for FY 2008 and Beyond," and signed by the Secretary of the Navy, the Chief of Naval Operations, and the Commandant of the Marine Corps. The other five objectives listed in the memorandum are "Provide a Total Naval Workforce capable and optimized to support the National Defense Strategy," "Build the Navy-Marine Corps Force for Tomorrow," "Safeguard the People and Resources of the Navy-Marine Corps Team [and] Integrate Safety and Risk Management into all on and off-duty evolutions to maximize mission readiness and to establish DON [the Department of the Navy] as an organization with world class safety where no mishap is accepted as the cost of doing business," "Strengthen ethics as a foundation of exemplary conduct within the Department of the Navy," and "Provide first-rate facilities to support stationing, training and operations of Naval forces." (Underlining as in the original.)

¹⁴⁸ For a detailed discussion, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

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.

The final report on the 2005 Quadrennial Defense Review (QDR) directed the Navy “to adjust its force posture and basing to provide at least six operationally available and sustainable carriers and 60% of its submarines in the Pacific to support engagement, presence and deterrence.”¹⁴⁹

As shown in **Table 6**, the Navy in FY2007 shifted roughly 20 ships from the Atlantic Fleet to the Pacific Fleet. As a result, the Pacific Fleet’s share of the total Navy, which had been roughly 45% to 47% in earlier years, was increased in 2007 to about 54%, and the total number of Pacific Fleet ships in 2007 was about equal to the number in FY1998, even though the total size of the Navy declined by 54 ships between FY1998 and FY2007.

Table 6. Pacific Fleet’s Share of the Navy, FY1995-FY2007

FY	Total number of ships in Navy	Atlantic Fleet		Pacific Fleet	
		Number of ships	% of Navy total	Number of ships	% of Navy total
1995	373	205	55.0%	168	45.0%
1996	356	292	53.9%	164	46.1%
1997	354	192	54.2%	162	45.8%
1998	333	183	55.0%	150	45.0%
1999	317	172	54.3%	145	45.7%
2000	318	174	54.7%	144	45.3%
2001	315	174	55.2%	141	44.8%
2002	313	168	53.7%	145	46.3%
2003	297	158	53.2%	139	46.8%
2004	291	153	52.6%	138	47.4%
2005	282	149	52.8%	133	47.2%
2006	281	149	53.0%	132	47.0%
2007	279	128	45.9%	151	54.1%

Source: Prepared by CRS based on U.S. Navy data.

As of the end of FY2007, the Pacific Fleet included, among other things, 6 of the Navy’s 11 aircraft carriers, almost all of the 18 Aegis cruisers and destroyers that have been modified for ballistic missile defense (BMD) operations, and 26 of the Navy’s 57 attack submarines (SSNs), or about 46%. (When both ballistic missile submarines [SSBNs] and SSNs are included in the count, the totals become 34 of 71

¹⁴⁹ U.S. Department of Defense, *Quadrennial Defense Review Report*. Washington, 2006. (February 6, 2006) p. 47.

of submarines of all kinds, or about 48%.) The Navy reportedly plans to have 60% of its SSNs in the Pacific Fleet by 2010.¹⁵⁰ As of February 2008, the Pacific Fleet SSN force included all three of the Navy's powerful Seawolf (SSN-21) class attack submarines (SSNs). The Seawolf design was originally developed in the 1980s in large part to counter the Soviet Union's large submarine force.¹⁵¹

In light of the transfer in 2007 of about 20 additional ships to the Pacific Fleet, a potential oversight question for Congress is whether the Navy's steps to increase the Pacific Fleet's share of the total Navy are inadequate, excessive, or about right.

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. Expanding the number of ships to be homeported in the Western Pacific could require construction of additional homeporting and support 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.

A 2002 Congressional Budget Office (CBO) report discussed the option of homeporting as many as 11 SSNs at Guam,¹⁵² compared with the 3 that are currently homeported there. In April 2007, it was reported that the Navy was considering transferring a group of three amphibious ships, including a large amphibious assault ship, from the continental United States to Pearl Harbor, Hawaii.¹⁵³ In July 2007, it was reported that the Navy had issued contracts indicating that it intends to transfer two additional mine-countermeasures ships in 2009 from Ingleside, Texas (a Navy home port that is scheduled to close in 2010), to Sasebo, Japan, where a group of Navy amphibious ships and two mine warfare ships are already homeported.¹⁵⁴

Number of Aircraft Carriers. *How many aircraft carriers should the Navy include?*

¹⁵⁰ Mike Barber, "Navy's Fast-Attack Submarine Signals News Mission In Pacific," *Seattle Post-Intelligencer*, February 1, 2008.

¹⁵¹ Ibid.

¹⁵² U.S. Congressional Budget Office, *Increasing the Mission Capability of the Attack Submarine Force*, Washington, CBO, 2002. (A CBO Study, March 2002), 41 pp.

¹⁵³ William Cole, "Pearl Harbor May Get Navy Ship Group," *NavyTimes.com*, April 16, 2007.

¹⁵⁴ Christopher J. Castelli, "U.S. Navy Plans To Move Two More Minesweepers To Japan In 2009," *Inside the Navy*, July 23, 2007.

The Navy's proposal for a 313-ship fleet includes 11, and eventually 12, aircraft carriers. The issue of how many carriers the Navy should operate is discussed at some length in another CRS report.¹⁵⁵ Advocates of maintaining a force of at least 11 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 11 carriers is needed to deter or prevail in such a conflict. Those supporting a reduction in the carrier force to fewer than 11 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 48, or some other number?*

The Navy's proposal for a 313-ship fleet includes 48 SSNs (plus four converted Trident cruise missile submarines, or SSGNs). Supporters of SSNs have argued that China's naval modernization, and in particular China's submarine modernization, is a significant reason for supporting a force of 48 or more SSNs. The issue of the SSN force-level goal is discussed at length in another CRS report.¹⁵⁶

Although discussions of how U.S. SSNs would fit into U.S. Navy operations against PLA forces are 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 such operations. 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 48 or more 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.

¹⁵⁵ CRS Report RL32731, *Navy Aircraft Carriers: Proposed Retirement of USS John F. Kennedy — Issues and Options for Congress*, by Ronald O'Rourke.

¹⁵⁶ CRS Report RL32418, *Navy Attack Submarine Force-Level Goal and Procurement Rate: Background and Issues for Congress*, by Ronald O'Rourke.

- **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 48 or more 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 fewer than 48 SSNs could argue that U.S. SSNs, though very capable for performing certain missions, they are less capable for performing 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.

One set of observers stated in 2007 that China's new nuclear-powered submarines:

are entering the PLA Navy (PLAN) at a time when reductions are projected to occur in the U.S. Navy submarine force; that fact was duly noted by a senior PLAN strategist recently in one of China's premier naval journals.¹⁵⁷

These same observers stated that:

Chinese researchers display intimate familiarity with all U.S. Navy submarine force programs, including the most cutting-edge platforms, such as Seawolf and Virginia. Additionally, there is great interest in the ongoing transformation of some SSBNs into SSGNs. Ample focus is also devoted to the capabilities of the Los Angeles class as the backbone of the U.S. Navy submarine force. Beyond platforms and programs, there is also a keen interest in America's industrial organization for nuclear submarine production and maintenance.¹⁵⁸

¹⁵⁷ Andrew S. Erickson and Lyle J. Goldstein, "China's Future Submarine Force: Insights From Chinese Writings," *Naval War College Review*, Winter 2007: 55-56.

¹⁵⁸ Andrew S. Erickson and Lyle J. Goldstein, "China's Future Submarine Force: Insights From Chinese Writings," *Naval War College Review*, Winter 2007: 61.

These observers also stated that:

Chinese analysts acknowledge that America has long been dominant in undersea warfare, especially after the Cold War. Many Westerners are therefore surprised that China would have the temerity to challenge the United States directly in this specialized domain of warfare. Yet PLAN analysts keep close tabs on U.S. Navy submarine building rates and carefully probe for potential American submarine force vulnerabilities. They have studied the 8 January 2005 accident involving [the Los Angeles-class SSN] USS San Francisco¹⁵⁹ with great interest. A 2006 article by a senior PLAN strategist suggests that “China already exceeds [U.S. submarine production] five times over” and that eighteen U.S. Navy submarines based in the Pacific might be at a severe disadvantage against seventy-five or more Chinese submarines. While these assessments are ultimately attributed to an American source, the PLAN analyst makes no effort to deny or reject these assessments.¹⁶⁰

These observers elsewhere state that:

Chinese naval analysts study the U.S. submarine force in excruciating detail, as concretely manifested in thousands of both strategic and technical articles that focus on it....

Chinese discussions of the American submarine force focus heavily on the continuing decline in its size. As one article from a People’s Republic of China (PRC) naval-interest publication states, “The decline of U.S. submarine strength is inevitable.” Indeed, that a wide variety of Chinese naval sources share this evaluation suggests that this “decline” now passes for conventional wisdom within the PLA Navy. The Chinese naval community is likely paying close attention to internal U.S. debates, knowing that investments made (or forgone) today in submarine fleet modernization shape the future fleet....

Taking the long view, Chinese naval strategists recognize that force levels have dropped drastically from Cold War levels. One source observes, “Since 1989, the U.S. Navy’s nuclear-powered attack submarine [force] has been reduced by half.” A more recent Chinese naval press article estimates that “[U.S.] nuclear attack submarines will decline in number by close to 40%, eventually reaching 30 boats.” This calculation is roughly consistent with a projection in *Modern Navy* that anticipated a sustained build rate of one boat per year. Rear Admiral Yang Yi, writing in 2006 on the future size of the American submarine force, quoted one American analysis as follows: “China already exceeds [U.S. submarine production] five times over. . . . 18 [USN] submarines

¹⁵⁹ The quoted passage is referring at this point to the collision of the San Francisco with an undersea mountain near Guam — an accident that severely damaged the ship.

¹⁶⁰ Andrew S. Erickson and Lyle J. Goldstein, “China’s Future Submarine Force: Insights From Chinese Writings,” *Naval War College Review*, Winter 2007: 71. The first bracketed phrase identifying the San Francisco as a Los Angeles-class SSN was inserted by this CRS report for purposes of explanation; the second bracketed phrase referring to U.S. submarine production appears in the quoted passage.

against 75 or more Chinese navy submarines is obviously not encouraging [from the U.S. perspective].”¹⁶¹

Number of ASW-Capable Ships and Aircraft. *Will the Navy have enough ASW-capable ships over the next several years? 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.¹⁶²

As discussed below in the section on ASW, 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 proposal for a 313-ship fleet 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 for several years. This raises a potential question of whether the Navy will have enough ASW-capable ships over the next several years, 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 over the next several years, such as increased ASW training and exercises (see discussion below).

¹⁶¹ Gabriel Collins, Andrew Erickson, Lyle Goldstein, and William Murray, “Chinese Evaluations of the U.S. Navy Submarine Force,” *Naval College War Review*, Winter 2008: 70 and 81.

¹⁶² 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 and William Murray in *Hearing On Military Modernization and Cross-Strait Balance, Hearing Before the U.S.-China Economic and Security Review Commission*, February 6, 2004, pp. 149-150.

Navy Warfare Areas and Programs

Missile Defense.¹⁶³ 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;
- decoying MaRVs away from U.S. Navy ships; and
- 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.

Number of SM-3 Missiles Planned For Procurement. *Is the number of SM-3 interceptors that DOD plans to procure sufficient?*

The Standard Missile 3 (SM-3) is the Navy's ballistic missile defense interceptor. DOD is currently planning to procure a total of 147 SM-3s. One potential oversight issue for Congress is whether this planned total is sufficient in light of potential numbers of Chinese TBMs to be countered.

The House Armed Services Committee, in its report (H.Rept. 110-146 of May 11, 2007) on the FY2008 defense authorization bill (H.R. 1585), stated that:

the recent Capabilities Mix Study completed by U.S. Strategic Command has indicated that combatant commanders require twice as many SM-3 interceptors than the 147 that are currently planned.¹⁶⁴

The Senate Armed Services Committee, in its report (S.Rept. 110-77 of June 5, 2007) on the FY2008 defense authorization bill (S. 1547), stated:

Currently MDA plans to procure only some 147 SM-3 missiles of all Block I varieties. The Commander, Joint Forces Component Command for Integrated Missile Defense (JFCC-IMD) testified in April 2007 that recent analyses indicate a need to nearly double the number of planned SM-3 interceptors. The committee urges MDA to plan and budget for increased numbers of SM-3 interceptors to

¹⁶³ For more on sea-based defense, including the first two issues discussed in this section, see CRS Report RL33745, *Sea-Based Ballistic Missile Defense — Background and Issues for Congress*, by Ronald O'Rourke.

¹⁶⁴ H.Rept. 110-146, p. 235.

meet the needs of regional combatant commanders, as indicated by the Commander, JFCC-IMD.¹⁶⁵

A May 2007 press report stated that:

A preliminary DOD study points to the need for more Standard Missile-3 (SM-3) sea-based missile defense interceptors and Terminal High-Altitude Area Defense (THAAD) interceptors, according to Lt. Gen. Kevin Campbell, commander of U.S. Army Space and Missile Defense Command (SMDC).

The study examined various major combat operations around the world, estimating the percentages of enemy missiles that would be taken out by conventional forces or felled by system failures. The current SM-3/THAAD interceptor inventory then was compared to a list of critical assets identified by DOD combatant commanders that need to be defended.

Near-term U.S. missile defense capabilities are “limited” primarily by interceptor inventory, Campbell said at a May 16 breakfast in Washington sponsored by National Defense University. In addition to SM-3s and THAAD interceptors, DOD also needs more Patriot battalions and ground-based interceptors, according to Campbell.¹⁶⁶

In late November 2007, Rear Admiral Alan Hicks, Aegis BMD program director, reportedly stated that

that even with 132 Standard Missiles (SMs) expected in the inventory by 2013, there should be more to meet potential global requirements.

“We need more than that,” he said Nov. 28. “Inventory is inadequate to meet our needs.” ...

But the admiral acknowledged that Aegis SM inventory also must be weighed against Theater High Altitude Area Defense and Patriot Advanced Capability missile inventories.¹⁶⁷

Another press report based on the same speech by Hicks stated that

Hicks observed that the military will have 153 short- and mid-term missile interceptors in the inventory by the end of 2009, but added that he believes the Navy needs to expand the program beyond current plans. “Is it enough? No,” Hicks said. Inventory’s inadequate to meet our needs.¹⁶⁸

¹⁶⁵ S.Rept. 110-77, p. 264.

¹⁶⁶ Jefferson Morris, “Study Points To Need For More SM-3s, THAAD Interceptors,” *Aerospace Daily & Defense Report*, May 17, 2007: 3.

¹⁶⁷ Michael Bruno, “Aegis BMD Program Chief Calls for More Missiles,” *Aerospace Daily & Defense Report*, November 29, 2007: 1-2.

¹⁶⁸ Megan Scully, “FY08 Funding Boost To Help Navy Deploy Missile Defenses,” *National Journal’s CongressDailyPM*, November 28, 2007.

Sea-Based Terminal Defense Program. Is the Missile Defense Agency's sea-based terminal missile defense program sufficiently robust?

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 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.

As the successor to the NAD program, MDA has initiated a new the sea-based terminal-defense acquisition effort that it has divided into two blocks — the Block 2.0 version and a far-term sea-based terminal capability that MDA places beyond Block 5.0.

The Block 2.0 sea-based terminal capability includes a fuze-modified SM-2 Block IV interceptor with a blast-fragmentation warhead. The missile is intended to be capable of intercepting a finite set of SRBMs inside the atmosphere. The Navy (not MDA) is funding the modification of up to 100 SM-2 Block IV missiles into this configuration. The Block 2.0 capability is scheduled to enter service in FY2009.

The far-term sea-based terminal capability is envisioned as including a new type of missile, the design of which is not yet determined, that is to provide a more capable sea-based terminal capability. Under current plans, the far-term sea-based terminal capability might enter service around 2015.¹⁶⁹ Potential candidates for the far-term sea-based terminal interceptor include a modified version of the Army's Patriot Advanced Capability-3 (PAC-3) interceptor called the PAC-3 Missile Segment Enhancement (MSE), or a modified version of the SM-6 Extended Range Active Missile (SM-6 ERAM) air defense missile being developed by the Navy.¹⁷⁰

¹⁶⁹ Dan Taylor, "Navy Still Interested in Second MKV, MDA Will Talk to Congress," *Inside the Navy*, December 3, 2007.

¹⁷⁰ See, for example, Bettina H. Chavanne, "Aegis Ships To Get Protection From Ballistic Missile Threats," *Aerospace Daily & Defense Report*, March 20, 2008: 2; 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.

In light of PLA TBM modernization efforts, including the possibility of TBMs equipped with MaRVs capable of hitting moving ships at sea, one potential issue is whether MDA's sea-based terminal program is sufficiently robust in terms of schedule and annual funding levels.

Accelerating CG(X) Procurement.¹⁷¹ *Should planned procurement of the CG(X) cruiser be accelerated?*

The Navy is planning to procure a new kind of cruiser called the CG(X) as the replacement for its 22 remaining Ticonderoga (CG-47) class Aegis cruisers. Navy plans call for the CG(X) to be equipped with a new radar that, compared to the Aegis system's SPY-1 radar, is more powerful and thus more capable for supporting ballistic missile defense operations.

As part of its FY2006-FY2011 Future Years Defense Plan (FYDP) submitted to Congress in February 2005, the Navy accelerated the planned start of CG(X) procurement from FY2018 to FY2011. The Navy wants to procure a total of 19 CG(X)s between FY2011 and FY2023. If procured on that schedule, the ships might enter service between 2017 and 2029.

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 it would be feasible to accelerate planned CG(X) procurement. Given the time needed to develop the CG(X)'s new radar, it might not be possible to accelerate the procurement of the first CG(X) from FY2011 to an earlier year.

Once CG(X) procurement were to begin, however, it might be possible to accelerate the procurement dates of later ships in the program, so as to get more of the ships in service sooner. In light of the CG(X)'s potential procurement cost, accelerating procurement of CG(X)s to earlier years would, in a situation of a constrained Navy budget, leave less funding available in those years for meeting other Navy needs.

Air Warfare.

Carrier-Based Unmanned Combat Air System (UCAS). *Should development of the Navy's carrier-based unmanned combat air system (UCAS) be accelerated? Should the Navy increase the number of UCASs that it plans to deploy on its carrier air wings?*

The Navy is currently developing a stealthy, long-range, unmanned combat air system (UCAS) for use in the Navy's carrier air wings. The prototype for the aircraft looks somewhat like a small version of the B-2 bomber. The aircraft potentially could be used for intelligence, surveillance and reconnaissance (ISR) operations, air-to-air warfare, air-to-ground warfare, and perhaps even antisubmarine warfare. The

¹⁷¹ For more on this issue, see CRS Report RL34179, *Navy CG(X) Cruiser Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

demonstration program for the system is called UCAS-D. The subsequent production version of the aircraft is called N-UCAS, with the N standing for Navy.

Some observers, including analysts at the Center for Strategic and Budgetary Assessments (CSBA), believe that N-UCAS would be highly useful, if not critical, for countering improved Chinese maritime military forces. N-UCASs, they argue, could be launched from a carrier shortly after the ship leaves port in Hawaii, be refueled in flight, and arrive in the Taiwan Strait area in a matter of hours, permitting the carrier air wing to contribute to U.S. operations there days before the carrier itself would arrive. They also argue that N-UCASs would permit Navy carriers to operate effectively while remaining outside the reach of China's anti-access weapons, including ASBMs. These observers argue that funding for UCAS-D should be increased, so as to accelerate the completion of the demonstration program, and that the Navy should expand the number of N-UCASs that it plans to put on its carrier air wings.¹⁷²

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, plans to procure a mix of F/A-18E/F Super Hornet strike fighters and 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. 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 F-22 Raptor strike fighters and 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-22s and JSFs will be needed in the future in part to counter fourth-

¹⁷² Thomas P. Ehrhard and Robert O. Work, *The Unmanned Combat Air System Carrier Demonstration Program: A New Dawn For Naval Aviation?*, Center for Strategic and Budgetary Assessments, Washington, 2007. 39 pp. (CSBA Backgrounder, May 10, 2007). The authors briefed key points from this document on July 11, 2007, in room S-211 of the Capitol.

generation fighters and strike fighters operated by other countries, including China. Supporters of the F-22 argue that the challenge posed by fourth-generation fighters in combination with modern integrated air defenses, is a key reason for procuring 381 or more F-22s, rather than the planned number of 179.¹⁷³ Potential oversight questions include the following:

- If the Air Force is correct in its belief that a combination of F-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 that includes fourth-generation fighters and strike fighters and modern SAMs?
- If PLA attacks on U.S. air bases in the Western Pacific reduce the number of Air Force F-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?¹⁷⁴

A January 30, 2008 defenses trade press article stated:

Boeing is touting an even newer version of its F/A-18E/F Super Hornet that, paired with an advanced sixth-generation fighter in the works at the company, would give customers what Boeing deems a better package of capabilities than Lockheed Martin's combination of the F-22 Raptor and F-35 Joint Strike Fighter.

The idea is that customers could buy 4.5 generation Super Hornets (perhaps 4.75 generation with the planned extra forward stealth and extra range of Block 3 aircraft) and then switch to a new, sixth generation faster than if they bought the fifth generation Joint Strike Fighter. To be available circa 2024, the sixth generation aircraft would feature a combat radius of more than 1,000 miles and stealth against a much wider spectrum of radars.

"The [Navy] C-version of the F-35 doesn't buy you a lot that the Super Hornet doesn't provide," says Bob Gower, Boeing's vice president for F/A-18 and EA-18G programs. "Our strategy is to create a compelling reason for the services to go to the next [sixth] generation platform. How do you bridge

¹⁷³ For more on the F-22, JSF, and F/A-18E/F, see CRS Report RL33543, *Tactical Aircraft Modernization: Issues for Congress*; CRS Report RL31673, *F-22A Raptor*; 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 Bolkom.

¹⁷⁴ An article by an Air Force officer raises a related issue — whether Air Force aircraft have sufficient capability for attacking targets at sea to adequately assist Navy aircraft in countering Chinese naval forces operating in the Strait of Mallaca area as part of a "string of pearls" strategy. See Lawrence Spinetta, "Cutting China's 'Sting of Pearls,'" *U.S. Naval Institute Proceedings*, October 2006: 40-42.

F/A-18E/F to get us there? We want to convince customers to stay with [Super Hornet] a few years longer — by adding advanced capabilities and lowering price — so that they can get to the sixth generation faster. If you go to JSF first, it's going to be a long time.”

Another part of Boeing's argument is that the “Navy is comfortable with the Super Hornet against the highest [enemy] threat through 2024, with the [improved] capabilities we have in the flight plan,” Gower says. “The ability to counter the threat gets you to about the point that [Boeing's] sixth generation is available.”

It's part of Boeing's counterattack on Lockheed Martin's claim that the decreasing price of the F-22, which is now at \$140 million each, will make it so attractive that Australia may reconsider its buy — already being paid for — of 24 two-seat F/A-18F Super Hornets. Until Australia's recent change in government, a number of U.S. officials said the government was considering a second lot of 24 Super Hornets and a six-plane squadron of EA-18G Growlers.

Boeing makes the argument that a sliding in-service date for the JSF is worrying both the Australians and the U.S. military.

“The U.S. Air Force and Navy are now talking a lot more about where they need to go with sixth generation to get beyond JSF,” Gower says. “It could be unmanned, but I think you will see a combination of missions — some manned, some unmanned.”

For Boeing, the real discriminators are going to be extended range (1,000-1,500 miles), a small radar signature against low-frequency radars, expanded awareness through connections with the network, and the ability to carry a number of bombs internally.¹⁷⁵

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.¹⁷⁶ Potential areas for modernization include, among other things, the following:

¹⁷⁵ David A. Fulghum, “Boeing Plans Sixth Generation Fighter Along With Block 3 Super Hornet,” *Aerospace Daily & Defense Report*, January 30, 2008: 1-2.

¹⁷⁶ 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.

- ship radars, such as the SPY-1 radar on Aegis ships or the radars now planned for the DDG-1000 destroyer and CG(X) cruiser;¹⁷⁷
- AAW-related computer networking capabilities, such as the Cooperative Engagement Capability (CEC) and the Naval Integrated Fire Control-Counter Air (NIFC-CA) system;¹⁷⁸
- air defense missiles such as the Standard Missile,¹⁷⁹ 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.¹⁸⁰

¹⁷⁷ For more on the DDG-1000 and CG(X), see CRS Report RL32109, *Navy DDG-1000 Destroyer Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke, and CRS Report RL34179, *Navy CG(X) Cruiser Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

¹⁷⁸ For more on CEC and NIFC-CA, see CRS Report RS20557, *Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress*, by Ronald O'Rourke.

¹⁷⁹ 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.

¹⁸⁰ 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, stated:

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

The Navy's Littoral Combat Ship (LCS) is to be armed with 11 Rolling Airframe Missiles (RAMs). The ship will also be equipped with an AAW decoy launcher.¹⁸¹

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, DDG-1000 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 are 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 11-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). Countering a substantial number of PLA 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

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 Tony Capaccio, "Navy Can't Test Defense Against China's 'Sizzler' Until 2014," *Bloomberg.com*, April 3, 2008; John Liang, "DSB Highlights 'Dire' Need For Supersonic Cruise Missile Targets," *Inside the Navy*, November 14, 2005.

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.)

¹⁸¹ For more on the LCS, see CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

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 at least some of the waters around Taiwan are reportedly poor for ASW, which could make the task of countering PLA submarines in these areas more difficult.¹⁸² 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 fields with manned and unmanned vehicles will change ASW from a "platform-intensive" to a "sensor-rich" operation, it adds.¹⁸³

¹⁸² See, for example, the statement of Lyle J. Goldstein and William Murray in Hearing On Military Modernization and Cross-Strait Balance, *Hearing Before the U.S.-China Economic and Security Review Commission*, February 6, 2004, pp. 148, 150, and 152.

¹⁸³ 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,

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 (CNO) 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.¹⁸⁴

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.)

¹⁸⁴ 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 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.)

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.¹⁸⁵

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, unmanned vehicles, and technologies for networking ASW systems and platforms. In March 2007, Admiral Mullen, who was then the CNO, testified that:

Submarines with improving stealth and attack capability — particularly modern diesel attack submarines — are proliferating world-wide at an alarming rate. Locating these relatively inexpensive but extremely quiet boats presents our Navy with a formidable challenge. Navy is pursuing a distributed and netted approach to ASW. Some of the key ASW programs we must continue to develop and field as quickly as possible include: the Deployable Distributed Autonomous system (DADS); the Reliable Acoustic Path Vertical Line Array (RAPVLA); the Surface Ship Torpedo Defense System (SSTD); the Aircraft Carrier Periscope Detection Radar (CVNPDR); and, the High Altitude ASW Weapon Concept (HAAWC)....

The Navy continues to pursue research and development of Distributed Netted Sensors (DNS); low-cost, rapidly deployable, autonomous sensors that can be fielded in sufficient numbers to provide the cueing and detection of adversary submarines far from the Sea Base. Examples of our FY 2008 request of \$24 million in these technologies include:

- Reliable Acoustic Path, Vertical Line Array (RAP VLA). A passive-only distributed system exploiting the deep water propagation phenomena. In essence, a towed array vertically suspended in the water column.
- Deep Water Active Distributed System (DWADS). An active sonar distributed system optimized for use in deep water.
- Deployable Autonomous Distributed System (DADS). A shallow water array, using both acoustic and non-acoustic sensors to detect passing submarines. DADS will test at sea in FY 2008.
- Littoral ASW Multi-static Project (LAMP). A shallow water distributed buoy system employing the advanced principles of multi-static (many receivers, one/few active sources) sonar propagation.

¹⁸⁵ 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.

Further developing the Undersea Warfare Decision Support System (USW-DSS) will leverage existing data-links, networks, and sensor data from air, surface, and sub-surface platforms and integrate them into a common ASW operating picture with tactical decision aids to better plan, conduct, and coordinate ASW operations. We are requesting \$23 million in FY 2008 towards this system.

To engage the threat, our forces must have the means to attack effectively the first time, every time. The Navy has continued a robust weapons development investment plan including \$293 million requested in the FY 2008 on such capabilities as:

- High-Altitude ASW Weapons Concept (HAAWC). Current maritime patrol aircraft must descend to very low altitude to place ASW weapons on target, often losing communications with the sonobuoy (or distributed sensor) field. This allows the aircraft to remain at high altitude and conduct an effective attack while simultaneously enabling the crew to maintain and exploit the full sensor field in the process. This capability will be particularly important in concert with the new jet-powered P-8A MMA. A test is scheduled for May 2007.
- Common Very Lightweight Torpedo (CVLWT). The Navy is developing a 6.75" torpedo suitable for use in the surface ship and submarine antitorpedo torpedo defense, and the offensive Compact Rapid Attack Weapon (CRAW) intended for the developing manned and unmanned aerial vehicles....

Platform Sensor Improvements. Against the quieter, modern diesel-electric submarines, work continues on both towed arrays and hull mounted sonars. Our \$410 million request in FY 2008 includes work on the following:

- TB-33 thin-line towed array upgrades to forward deployed SSN's provides near term improvement in submarine towed array reliability over existing TB-29 arrays. TB-33 upgrades are being accelerated to Guam based SSN's.
- Continued development of twin-line thin line (TLTL) and vector-sensor towed arrays (VSTA) are under development for mid-far term capability gaps. TLTL enables longer detection ranges/contact holding times, improves localization, and classification of contacts. VSTA is an Office of Naval Research project that would provide TLTL capability on a single array while still obviating the bearing ambiguity issue inherent in traditional single line arrays.¹⁸⁶

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

¹⁸⁶ Statement of Admiral Michael G. Mullen, Chief of Naval Operations, Before the House Armed Services Committee, 01 March 2007, pp. 8, 43-45.

ASW Command, based in San Diego, to provide more focus to its ASW efforts, and since then has taken various steps to enhance its ASW training and exercises. 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. In March 2007, Admiral Michael Mullen, who was then the CNO, testified that the Navy's surface ship torpedo defense (SSTD) program

delivers near term and far term torpedo defense. The planned FY 2008 \$16 million R&D [research and development] investment supports ongoing development of the 6 ¾ inch Common Very Lightweight Torpedo (CVLWT) which supports both the Anti-Torpedo Torpedo (ATT) and the Compact Rapid Attack Weapon (CRAW). Also, several capability upgrades to the AN/SLQ-25A (NIXIE) [torpedo decoy system] are being incorporated to improve both acoustic and nonacoustic system performance to counter current threat torpedoes. These enhancements also support their use in the littorals and are scheduled to complete in FY 2009. The AN/WSQ-11 System uses active and passive acoustic sensors for an improved torpedo Detection Classification and Localization (DCL) capability, and a hard kill Anti-Torpedo Torpedo (ATT) to produce an effective, automated and layered system to counter future torpedo threats. DCL improvements include lower false alarm rates and better range determination.¹⁸⁷

The ATT is currently scheduled to enter service in 2017. Navy officials state that changes to the program's funding profile could accelerate the ATT's entry into service by two years, to 2015.¹⁸⁸

In light of the modern torpedoes, including wake-homing torpedoes, that are expected to be carried by modern PLA submarines, a potential question is whether the current ATT acquisition schedule should be accelerated.

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

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

¹⁸⁷ Statement of Admiral Michael G. Mullen, Chief of Naval Operations, Before the House Armed Services Committee, 01 March 2007, p. 45.

¹⁸⁸ Source: Navy briefing to CRS and Congressional Budget Office, April 14, 2008.

in Congress and elsewhere in previous years.¹⁸⁹ The Navy for the past several years has been developing several new MCM systems that are scheduled to enter service over the next few years. Unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs) are playing an increasing role in MCM operations.

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.¹⁹⁰

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

The PLA's published interest in cyberwarfare, 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.¹⁹¹ A December 2007 article stated:

The Navy Cyber Defense Operations Command, located in Norfolk, VA, has about 170 people running a "24/7 watch," said James Granger, the command's technical director.

They are monitoring Navy-Marine Corps Networks, which includes [sic] the Navy-Marine Corps Intranet and tactical networks, with 761,000 users on 300 bases in 16 countries. Those networks receive about 90,000 potentially harmful probes every hour, and have been affected by 60,000 software worms and viruses since 2001, according to Network Warfare Command statistics....

¹⁸⁹ 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.

¹⁹⁰ Current information on Navy mines and mine development programs is available on the Internet at [<http://www.exwar.org/Htm/4000.htm>].

¹⁹¹ 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.

What is now the Cyber Defense Command started in about 1995 as a division of the Fleet Information Warfare Center and became a separate command as the Navy Computer Instant Response Team in 2003, before assuming its current identity under Network Warfare Command....

The command's operations are also closely tied in with the overall Defense Department network security efforts, directed by the Joint Task Force for Global Network Operations in Washington, which, in turn, falls under the U.S. Strategic Command in Omaha, Neb.¹⁹²

Another CRS report discusses computer network security at length.¹⁹³

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

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.¹⁹⁴

¹⁹² Otto Kreisher, "“Risk to One Is Risk to All,”" *Seapower*, December 2007: 28-30.

¹⁹³ CRS Report RL32114, *Computer Attack and Cyberterrorism: Vulnerabilities and Policy Issues for Congress*, by Clay Wilson.

¹⁹⁴ *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

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.

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 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.)

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 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.¹⁹⁵

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.

¹⁹⁵ Source: Transcript of hearing.

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.¹⁹⁶

Legislative Activity for FY2008

FY2008 Defense Authorization Act (H.R. 1585/S. 1547/H.R. 4986/P.L. 110-181)

House. Section 1244 of the House-reported version of the FY2008 defense authorization bill (H.R. 1585) stated:

SEC. 1244. SENSE OF CONGRESS CONCERNING THE STRATEGIC MILITARY CAPABILITIES AND INTENTIONS OF THE PEOPLE'S REPUBLIC OF CHINA.

It is the sense of Congress that —

(1) United States military war-fighting capabilities are potentially threatened by the strategic military capabilities and intentions of the People's Republic of China, as demonstrated by —

(A) the October 2006 undetected broach of a Chinese SONG-class diesel-electric submarine in close proximity of the USS Kitty Hawk in international waters; and

(B) the January 2007 test of a direct ascent anti-satellite (ASAT) weapon, posing a potential threat to United States military assets in space;

(2) it is in the national security interests of the United States to make every effort to understand China's strategic military capabilities and intentions; and

(3) as part of such an effort, the Secretary of Defense should expand efforts to develop an accurate assessment of China's strategic military modernization, particularly with regard to its sea- and space-based strategic capabilities.

Senate. The Senate-passed version of the FY2008 defense authorization bill (S. 1547; S.Rept. 110-77 of June 5, 2007) did not contain a provision analogous to Section 1244 of the House-passed version of H.R. 1585 (see above).

Conference. The conference report (H.Rept. 110-477 of December 6, 2007) on H.R. 1585 did not contain a provision analogous to the Sec. 1244 of the House-passed version of H.R. 1585. The conference report stated:

¹⁹⁶ Ibid.

The conferees note China's continued investment in strategic military capabilities that could be used to support power projection and access denial operations beyond the Asia Pacific region, and the lack of transparency surrounding the strategic military capabilities and intentions relating to China's military modernization. The Pentagon's 2006 Quadrennial Defense Review Report (QDR) found that China is at a strategic crossroads and that, "of the major and emerging powers, China has the greatest potential to compete militarily with the United States." The conferees note that during the last year, China demonstrated such potential, including the October 2006 broach of a Chinese SONG-class diesel-electric submarine in close proximity to the USS Kitty Hawk aircraft carrier in international waters and the January 2007 test of a direct ascent anti-satellite missile against a Chinese weather satellite in low-earth orbit.

The conferees encourage the Secretary of Defense to expand efforts to develop an accurate assessment and understanding of China's strategic military modernization and strategic intentions, particularly with regard to its sea- and space-based strategic capabilities. (Page 1031)

H.R. 1585 was vetoed by the President on December 28, 2008. A new bill, H.R. 4986, was passed with changes that took into account the President's objection to certain parts of H.R. 1585. The President's objection to certain parts of H.R. 1585 did not relate to the passage quoted above. H.R. 4986 was signed into law as P.L. 110-181 of January 28, 2008. Except for the changes made by Congress to take into account the President's objection to certain parts of H.R. 1585, H.Rept. 110-477 in effect serves as the conference report for H.R. 4986.

Appendix A. Examples of Expressions of Concern

This appendix presents some examples since 2005 of expressions of concern about China's military modernization, and of its potential implications for U.S. Navy requirements.

A May 2005 press report stated 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 [then-]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."¹⁹⁷

In an address delivered on February 7, 2007, Secretary of the Navy Donald Winter stated:

Naval forces must be ready, above all, to conduct major combat operations should the need arise.

We cannot ignore events and trends that reinforce that belief. A recent White Paper prepared by the Chinese military outlined a three-step strategy for modernizing its defense, to include its blue-water ambitions. The third step in their strategy states as a strategic goal "building modernized armed forces and being capable of winning modern, net-centric wars by the mid-21st century." This document implicitly suggests that China hopes to be in a position to successfully challenge the United States, a challenge that would certainly entail blue-water operations.

Public declarations such as this statement and many others serve as reminders that we must be prepared for a world that does not always follow our preferences. Of course, we hope that China will choose a peaceful path. But hope is not a strategy, so we must be prepared.

Those who might be tempted to dismiss or discount the need to be prepared for major combat operations ought to keep in mind that their goodwill and optimism towards totalitarian regimes may not be reciprocated.¹⁹⁸

¹⁹⁷ John M. Donnelly, "China On Course To Be Pentagon's Next Worry," *CQ Weekly*, May 2, 2005, p. 1126.

¹⁹⁸ Donald C. Winter, "Navy Transformation: A Stable, Long-Term View," *Heritage Lectures*, No. 1004, March 19, 2007, [remarks] delivered February 7, 2007, p. 2. (Published by The Heritage Foundation)

A press article reporting on an April 3, 2007, address by Admiral Michael Mullen, then the Chief of Naval Operations and now the Chairman of the Joint Chiefs of Staff, stated that in addition to other topics,

The admiral also commented on the threats that drive military spending needs. For example, he noted, China is building a new, modernized navy.

“The Chinese are shifting from land-centric” forces as their main focus “to air-centric and naval-centric” buildups. China is acquiring cutting-edge aircraft, new destroyers, four new classes of submarines, and hundreds of radar-guided missiles. “Those investments very much have our attention,” Mullen said.¹⁹⁹

Another short news article, reporting on comments made by Mullen at a breakfast meeting in early May 2007, stated that:

In response to a question about the need for large Navy vessels, Mullen [told] attendees that while he doesn’t expect to see big sea battles, the service has to be mindful of China’s naval build up. “China is very actively investing in their navy, building more ships each year. Their building rate is much higher than ours right now,” he says. “We have to be mindful of that. Not to be mindful of that would be irresponsible.”²⁰⁰

At a December 13, 2007, hearing before the House Armed Services Committee, Admiral Gary Roughead, the current Chief of Naval Operations, acknowledged that China’s rate of submarine production is a concern²⁰¹ and stated later that “my judgment is that it is a navy that is modernizing at a rate that is exceeding what our expectations have been.”²⁰²

At a March 6, 2008, hearing before the House Armed Services Committee, Admiral Roughead was asked by one Member, “can you tell us what attention is being paid to the China fleet and what we’re doing to counter-balance that?” Admiral Roughead replied:

Yes, sir. Having been the Pacific fleet commander and having served in the Pacific for several years, watching the evolution of China’s navy has been of great professional interest to me and then obviously in my positions out there, of great import to the Navy. There is no question that China is building a navy that

¹⁹⁹ Dave Ahearn, “Mullen Says Military Faces Financial Crisis, But Nation Can Afford Arms,” *Defense Daily*, April 5, 2007. The passage as originally published was in the form of five one-sentence paragraphs and has been condensed here into two paragraphs for ease of reading.

²⁰⁰ “Interesting Times,” *Defense Daily*, May 7, 2007.

²⁰¹ At the hearing, Representative Hunter stated to Admiral Roughead: “With respect to the increased [Chinese rate of submarine] production, in terms of them outstripping us by three-to-one on submarine production, and your own figures show that they are going to eclipse us in submarine numbers in 2011 — maybe little earlier, maybe a little later, depending on which analysis you go with: Clearly, that should be a concern to you.” Admiral Roughead replied: “Well, it is.” (Source: Transcript of the hearing.)

²⁰² Source: Transcript of hearing.

is increasing in sophistication and capacity. It is a navy that is focusing more on being able to influence events in the region and then being able to move on to the global stage.

As I watch what they are buying, what they are building, that's one component of watching the PLA Navy. But the other is their leadership and the expertise and competence of the leadership. I've had the opportunity to meet with several of the PLA Navy leaders. And it is clear to me that they have a path that they see for their navy.

It is a path that does not necessarily end with them being a threat. But it is a navy that, I believe, will have greater influence in the Pacific and then also moving into the Indian Ocean regions.

The key for us is to be able to engage with that leadership to gauge the intent, not only of the PLA Navy, but the PLA and to have a relationship that allows us to see where they are taking their navy and how competent that navy is. As you know, we have shifted force structure into the Pacific, carriers and submarines. But I would submit that that's not simply because of a rising PLA Navy.

It is because that is part of the world, that and the Indian Ocean region and the Arabian Gulf, where our prosperity hinges on. And that is the reason why I believe a rebalancing of the fleet into those areas where we can respond, where we can be present is so important. And it is from that response and presence that I am committed to the 313-ship Navy because of our need to be able to cover the many requirements that are there, not simply at the high end of naval capability, but also to be able to work with some of the other countries.²⁰³

An April 20, 2008, news report stated:

Chinese efforts to assure the world of its "peaceful rise" are being contradicted by a lack of transparency about its military build-up, the top US military commander in the Pacific said on Thursday.

China has failed to explain how the development of key weapons fit with its stated aim of becoming a great power without confrontation, US Pacific Command chief Admiral Timothy J Keating told reporters in the Indonesian capital.

"They (China) profess to seek a 'peaceful rise' and 'harmonious integration' and we're all for that. They have to show us how they intend to achieve that while developing these certain weapons," he said.

"And we think there is some contradiction between their stated role versus the practice, but we'll continue to work with them."

Adm Keating, who was on an official visit to Indonesia, said he had raised his desire for more transparency from the Chinese on two visits to the country so far this year, but talks had been "not entirely fruitful."

²⁰³ Source: Transcript of hearing. The question was asked by Representative Mike McIntyre.

“It’s our clear purpose to draw them out, to engage with them, to offer them the opportunity to observe exercises on a multilateral basis, simple though they may be, so as to ensure they are aware of what it is we are about,” Adm Keating said.²⁰⁴

²⁰⁴ Agence France Press, “China’s Military rise ‘Lacks Transparency’: US commander,” *The Straits Times*, April 10, 2008.

Appendix B. Additional Details on China's Naval Modernization Efforts²⁰⁵

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.

Missiles.

Theater-Range Ballistic Missiles (TBMs). Regarding the potential for using TBMs against moving U.S. Navy ships at sea, ONI stated in 2004 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."²⁰⁶ ONI continued:

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

²⁰⁵ Unless otherwise indicated, shipbuilding program information in this section is taken from *Jane's Fighting Ships 2007-2008*, and previous editions. Other sources of information on these shipbuilding programs may disagree regarding projected ship commissioning dates or other details, but sources present similar overall pictures regarding PLA Navy shipbuilding.

²⁰⁶ U.S. Department of the Navy, *Worldwide Maritime Challenges 2004*, Washington, prepared by the Office of Naval Intelligence. (Hereafter cited as *2004 ONI WMC*.) 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.²⁰⁷

Another observer stated in 2005:

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.²⁰⁸

A separate observer stated in 2005:

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.²⁰⁹

One more observer stated in 2005:

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

²⁰⁷ 2004 ONI WMC, p. 22. Page 20 stated: "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."

²⁰⁸ Prepared statement of Richard D. Fisher, Jr., for a July 27, 2005, hearing on China grand strategy and military modernization before the House Armed Services Committee, p. 6.

²⁰⁹ Presentation entitled "Beijing Eye View of Strategic Landscape" 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.

is a big Chinese weakness. Along with these efforts to develop ballistic missiles 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.²¹⁰

Land-Attack Cruise Missile (LACMs). Regarding LACMs, one observer stated in 2006:

Taiwanese civilian and military officials contend that in 2005 the PLA has started deployment of its long-awaited new land attack cruise missiles (LACMs). Asian sources contend that two Chinese companies are making LACMs; one for the Second Artillery missile forces, and one for PLA Navy and PLA Airforce platforms, most likely based on the new 300+ km range YJ-62 anti-ship missile. It has been well reported that China has sought to develop modern LACMs since the 1970s and has sought technology from Russia, Israel, and has obtained at least six Russian Novator Kh-55 LACMs via the Ukraine, and has obtained parts of U.S. RGM/UGM-109 Tomahawk LACMs via Iraq, Afghanistan and very likely, Pakistan. When these LACMs are married to new Russian-assisted EO and Radar satellites, French assisted communication satellite, access to U.S., Russian and European navigation satellites signals, and then carried by Russian assisted nuclear submarines or future Russian-made bombers, then the PLA will have its first limited non-nuclear global strike capability. Such a synergy could emerge by 2010 or shortly thereafter. This might not equal the U.S. all-weather intimate moving-target hitting capability, but China may be able to use LACMs for political-military influence much as the U.S. does today.²¹¹

Land-Based Surface-to-Air Missiles (SAMs). Regarding SAM systems, DOD stated in 2007:

In the next few years, China will receive its first battalion of Russian-made S-300PMU-2 surface-to-air missile systems. With an advertised intercept range of 200 km, the S-300PMU-2 provides increased lethality against tactical ballistic missiles and more effective electronic countermeasures. China also is developing the indigenous HQ-9 air defense missile system, a phased array radar-based SAM with a 150 km range.²¹²

Another observer stated in 2006:

²¹⁰ Prepared Statement of Eric McVadon for a September 15, 2005, hearing before the U.S.-China Economic and Security Review Commission, pp. 4-5.

²¹¹ Prepared statement of Richard D. Fisher, Jr., for a March 16, 2006, hearing before the U.S.-China Economic and Security Review Commission hearing, p. 9.

²¹² 2007 DOD CMP, p. 4

One area where Russian technology in particular is producing a new and dangerous PLA capability is that of modern air defenses. The PLA Air Force is on its way to purchasing up to 14 to 20 Battalions of Russian S-300/PMU-1/PMU-2 surface-to-air missiles (SAMs), which could mean the purchase of 700 to 1,000 of these deadly missiles. The S-300 family is very difficult to jam and can only be evaded with some assurance by stealthy F-22A or B-2 aircraft. The range of the S-300PMU-2 allows it to target aircraft that operate over Taiwan, thus denying the Taiwan Strait as an air defense buffer zone for the Taiwan Air Force. Jane's reports that China may be funding the development of the even longer-range S-400 missile, while Asian sources report that China may be co-producing the deadly short range TOR-M1,44 which can shoot down precision-guided cruise missiles and bombs.²¹³

Mines. A detailed open-source discussion of China's naval mining capabilities appeared in the Winter 2007 edition of *Undersea Warfare*, a publication of the U.S. Navy's submarine community. Because such discussions are few in number, it is excerpted here at length. The excerpt runs for about five pages. The authors state that, compared to the China's submarine modernization effort,

Less well understood by naval analysts and planners is the People's Liberation Army (PLA) Navy's dynamic mine warfare component. It is important to understand this emerging capability, because sea mines appear to be a big component of Beijing's Anti-Submarine Warfare (ASW) strategy....

The major conclusions of [a larger study that surveyed nearly one thousand Chinese language articles related to mine warfare] are that China's naval mine inventory likely contains some of the world's most lethal systems and that Beijing may be on the cutting edge of mine warfare (MIW) technology and concept development. The study elucidates a preliminary outline of a Chinese MIW doctrine that emphasizes speed, psychology, obfuscation, a mix of old and new technologies, and a variety of deployment methods that target very specific U.S. Navy platforms and doctrines....

It seems that the PLA Navy sees mine warfare as a feasible "poor man's ASW" — providing a stopgap measure until Beijing has put a more robust ASW posture into place. Chinese strategists note that "submarines are acutely vulnerable to mines, because passive sonar is not likely to be effective in locating mines, and because submarines have very limited organic²¹⁴ mine counter measures (MCM) capabilities."...

Lacking a substantial modern naval history, Chinese naval analysts are scrupulously analyzing foreign naval history for lessons to facilitate their development, and have duly noted the potential for mine warfare to "baffle the enemy, and thus achieve exceptional combat results."... Perhaps not surprisingly, Chinese naval strategists have a keen understanding of Soviet naval doctrine, appreciating in particular how mine warfare was revived during the late Cold War in part for the purpose of countering American nuclear powered fast-attack

²¹³ Prepared statement of Richard D. Fisher, Jr., for a March 16, 2006, hearing before the U.S.-China Economic and Security Review Commission hearing, p. 11.

²¹⁴ "Organic" here mines MCM capabilities that are installed on the submarine itself and are therefore intrinsic (i.e., organic) to the submarine.

submarines (SSNs). Indeed, one Chinese survey of ASW explains how new mines emerged in the 1980s “that are more appropriate to the requirements of modern anti-submarine warfare.” A detailed Chinese analysis of Russian rocket mines concludes: “...these weapons will attack SSNs too rapidly for countermeasures to engage, and are also rated to be highly effective against the mono-hull construction of U.S. submarines.” Chinese strategists have also very closely analyzed the mine warfare aspects of the Persian Gulf War during 1990-91, noting that although two U.S. Navy (USN) ships were severely damaged, Iraq’s MIW campaign had numerous flaws, including an “inappropriate reliance on moored mines [and a failure to execute] long range offensive mine warfare operations.” It is now conventional wisdom in the PLA Navy that “relative to other combat mission areas, [the U.S. Navy’s] mine warfare capabilities are extremely weak.”

PLA Navy strategists envision a wide array of platforms (including non-military vessels) for delivery of sea mines for operational deployment. Having systematically analyzed the advantages and disadvantages of these mine-laying platforms, they appear to have concluded that submarine delivery of mines is optimal for offensive, and especially long-range offensive, mining missions....

China reportedly possesses between 50,000 and 100,000 mines, consisting of “over 30 varieties of contact, magnetic, acoustic, water pressure and mixed reaction sea mines, remote control sea mines, rocket-rising and mobile mines....” People’s Liberation Army Navy (PLAN) submarines are said to use the Chen-1, -2, -3, and -6 type influence mines, “appropriate for use in the sea area immediately outside of harbor mouths;” the T-5 mobile mine, “appropriate for port channels and sea areas immediately outside a port;” and the Soviet-produced PMK-1 and the Chinese-developed Mao-5 rocket rising mines, “appropriate for waters up to 15 kilometers outside a port.”

China’s remotely controlled mines, such as the EM53 bottom influence mine, are thought to be deactivated by coded acoustic signals to allow the safe passage of friendly vessels, and again activated to prevent the transit of those of an enemy....

China likely also possesses an inventory of submarine launched mobile mines (SLMMs). Called “self-navigating mines” (zihang shuilei) in Chinese, these mines are simply torpedo bodies that carry a mine payload to waters inaccessible by other means. Apparently derived from Yu-class torpedoes, China’s SLMMs would travel along a user-determined course for a set period of time. When SLMMs arrived at their programmed destination (e.g. in the middle of a harbor), the torpedo’s engine would shut off, and the weapon would sink to the bottom where the warhead would be controlled by a fuse similar to that of any other bottom mine.

Significantly, China began to develop rocket rising mines in 1981 and produced its first prototype in 1989. Thus, Beijing has been working on this technology for well over two decades. Today, China reportedly offers two types of rising mines for export. Rising mine systems are moored, but have as their floating payload a torpedo or explosive-tipped rocket that is released when the mine system detects a suitable passing vessel. The torpedo or rocket rises from deep depth to home in on and destroy its intended target, typically a submarine. As one source notes, “The so-called ‘directional rocket rising sea mine’ is a type

of high technology sea mine with accurate control and guidance and initiative attack capacity.... Attack speed [e.g., against a target submarine] can reach approximately 80 meters per second.” China’s EM52, a guided rocket propelled destructive charge, reportedly has an operating depth of at least 200 meters. Russian rising torpedo mines such as the PMK-2 are said to be capable of being laid in waters as deep as 2,000 meters.

Recent focus on rocket rising mine development indicates for China “a new understanding of the art of sea mine warfare [whereby] it is essential to implement effective sea mine warfare over a vast range of deep sea areas [and to] develop and equip rocket sea mines capable of ... mobile attack.” The PLA Navy is therefore augmenting its existing inventory of 1970s-80s mines designed to defend littoral areas, most of which “can only be deployed in shallow seas,” and only a fraction of which can be deployed in medium depths. In particular, China’s navy has “started to outfit vertical rocket rising sea mines, and is energetically developing directional rocket sea mines, rocket rising guided missile sea mines and rocket assisted propulsion sea mines.”

An article in China’s leading naval publication refers to Russia as “the world’s ‘sea mine kingdom.’” China has reportedly imported Russian mines, technology, and even engineers to bolster its indigenous MIW programs. In this domain of warfare, Russia’s wide-ranging assistance has been a natural fit for PLA priorities. While the true scope of this collaboration remains unknown, Chinese analysts have clearly developed a sophisticated understanding of Russian mine development and doctrine. They note that Soviet interest in sea mines actually waned under Khrushchev, but was subsequently reinvigorated in the late 1960s, as it was realized that for conventional war scenarios, sea mines would play an ever greater role. One Chinese article emphasizes that Russia “has continuously paid great attention to the development of high speed undersea rocket techniques.”

Ongoing Chinese research foci suggest, however, that Beijing is not content to rely solely on Russian mines and technology. China appears, for instance, to be keenly interested in developing and enhancing the effectiveness of its indigenous deep water rising mines. Scientists at China’s Naval Aviation Engineering and Dalian Naval academies have developed methods to predict rocket propelled mine attack probability. A variety of additional studies have analyzed launch platform stability, underwater rocket propulsion, and launch trajectory. Additional naval mine research examines target tracking, blast maximization, and damage to ships. Researchers at one of China’s top technical universities have analyzed the extent to which targets can react to and evade deep water rising mines, and suggest using the passive signature of target vessels to aim the mines.

Submarines have attracted particular attention as a deployment platform for rising mines. An article by Dalian Naval Academy researchers suggests significant PLAN interest in SLMMs. A researcher at Institute 705 advocates acquisition of an encapsulated torpedo mine, similar to the Cold War-era U.S. Captor mine, which could be laid in very deep waters to attack passing submarines. Mine belts — external conformal containers designed to carry and release large numbers of mines — can be fitted to submarines in order to bolster their otherwise limited payloads. One article emphasizes that the Soviet navy developed a “mine laying module capable of carrying 50 sea mines on either side of the submarine” and states, “For the past few years related PLA experts have

expressed pronounced interest in submarine mine belts.... The PLA very probably has already developed submarine mine belts.” Another source notes, however, that “submarines built after World War II rarely carry mines externally.”

Disturbingly, there is some discussion of a theoretical nature in Chinese naval analyses concerning arming sea mines with tactical nuclear weapons. One such analysis, in the context of discussing Russian MIW, notes that nuclear sea mines could sink adversary nuclear submarines from a range of 2000 meters.... A second article finds that a nuclear payload is one logical method to increase the destructive power of sea mines, while a third analysis argues that nuclear MIW is especially promising for future deep-water ASW operations. It concludes: “At this time, various countries are actively researching this extremely powerful nuclear-armed sea mine.” An article in the July 2006 issue of *Modern Navy* (*Dangdai Haijun*), published by the PLA Navy itself, in the context of discussing potential future PLA Navy use of sea mines, also notes the potential combat value of nuclear-armed sea mines. While there is no direct evidence of the existence of such naval tactical nuclear weapons programs in China, these articles do perhaps suggest the need to closely monitor any Chinese efforts in this direction.

Recent Chinese MIW exercises have involved air, surface and even civilian platforms extensively. Of particular interest in this forum, however, is that China’s navy also considers mine laying from submarines to be “the most basic requirement of submarine warfare.” Mine-laying has become an integral component of recently enhanced Chinese submarine force training in which crews strive to conduct a wider variety of increasingly challenging exercises attuned to local environmental, hydrographic, and weather conditions. Such exercises are documented in some detail in the PLA Navy’s official newspaper, *People’s Navy* (*Renmin Haijun*). In particular, China’s navy views submarine delivery of mines as a critical aspect of future blockade operations. By 2002, mine-laying had become one of the most common PLAN submarine combat methods. Accordingly, PLAN crews train to handle submarines loaded with large quantities of mines. Drill variants include “hiding and laying mines in deep water.” Broad and deep mine-laying against port targets is also emphasized.

Chinese naval officers recognize the challenges inherent in “penetrating the enemy’s anti-submarine forces and laying mines behind enemy lines.” According to one PLA Navy captain, “Secretly penetrating the combined mobile formation deployed by the enemy’s anti-submarine forces is a prerequisite to fulfilling the mine-laying task.” There is some evidence that China may rely on centralized control of its submarines when conducting offensive mining missions. In carrying out offensive mine blockades, notes one Chinese analysis, “...if there is a shore-based submarine command post to handle command and guidance of the submarine for its entire course, it will not only ensure its concealment but also improve the strike effectiveness of the mines... that are laid.”

The Chinese Navy is working hard to improve the quality of its submarine officers and sailors, including their proficiency in MIW....

What would PLA Navy MIW operations look like in any potential conflict scenario? It is possible to imagine the extensive deployment of Chinese sea mines in conflicts arising out of hostilities in the South China Sea, or a possible conflict involving the Korean Peninsula. But the most operative scenario for

Chinese defense analysts now and in the foreseeable future involves the delicate future status of Taiwan.

The bathymetry of the waters proximate to Taiwan immediately reveals that the Taiwan Strait itself, as well as waters to the immediate north and south (adjacent to the island's largest ports), are shallow enough to create an environment for the use of all types of mines. Although Taiwan's eastern coast has deeper waters, the authors nevertheless believe that by relying on a combination method of deployment (air, surface, submarine and civilian) that a major Chinese MIW campaign could efficiently blockade Taiwan, especially if working in concert with the PLA Navy's submarine force. Chinese analysts, moreover, assess that Taiwan's MCM is inadequate to this challenge and that efforts by Taiwan to deploy its own mines could be dealt with by the PLA.

The above scenario represents the minimum that could be expected from offensive PLA MIW operations in a Taiwan scenario. One Chinese study on ASW suggests that mines are best employed against adversary submarines by laying "mines in the egress routes proximate to the enemy's bases... thus limiting the ability of enemy submarines to get out to the ocean." Indeed, it is conceivable that the PLA Navy could attempt to lay mines outside foreign bases. Such ranges are well within the endurance limits of PLA Navy submarines. When considering long distance offensive MIW operations, it is perhaps noteworthy that Chinese naval analysts have evaluated the "success" of German submarine mining efforts along the American coast during WWII. The waters around Japan's southern Ryukyus are also susceptible to Chinese offensive mining operations. Another article suggests: "On the basis of a great quantity of research, the PLA believes that U.S. nuclear submarines are very quiet, [are] difficult to... counterattack... [and] must [be] restrained..." According to this analysis, this concern has been a major impetus for Chinese research on mobile mines and the priority would be laying "[mobile] sea mines in each channel of the Pacific [Ocean's] First Island Chain, thereby forming together [a] blockade line [and] preventing U.S. nuclear submarines from entering China's nearby sea areas."...

Although China's naval development program remains rather opaque, it is clear mine warfare is a dynamic component of that program. The sources discussed above further suggest mine warfare may be a central component of China's evolving ASW doctrine. This has a variety of important implications. First and foremost, a strong consciousness with respect to the Chinese mine challenge should be developed. Training and doctrine must adjust accordingly. Programs related to submarine mine detection and neutralization deserve additional impetus. Second, the Navy should be actively involved in a mine warfare deterrence strategy. Nations should understand that the widespread use of mines in any maritime conflict would be extremely costly as these weapons could be deployed effectively against themselves. Finally, U.S. Navy planning must consider that the PLA Navy is preparing a strategy to counter American SSNs, such that deployment in a conflict scenario would entail new risks.²¹⁵

In another article, these same observers (plus an additional fourth author) state:

²¹⁵ Andrew Erickson, Lyle Goldstein, and William Murray, "China's Undersea Sentries," *Undersea Warfare*, Winter 2007, available online at http://www.navy.mil/navydata/cno/n87/usw/issue_33/china.html

While the overall impression [produced by a review of Chinese military literature] is that of [a] Chinese [self-assessment of] ASW [antisubmarine warfare] weakness, there is one notable exception. Significant prioritization appears to be given to the use of sea mines for the antisubmarine mission, as if to produce a “poor man’s ASW capability.” One discussion explains, “Because of a tremendous change in the maritime strategic environment, since the early 1990s the PLA has made mobile ASW sea mines a focal point of weapons development.” The analysis continues, “[China] is energetically undertaking the research mission [of] using [mobile ASW sea mines] against U.S. nuclear submarines.” The same discussion also hints at a possible PLA Navy ASW role: “The major mission of self-guided sea mines is to isolate American nuclear submarines outside the First Island Chain.”²¹⁶

Two of these same authors stated in a presentation in 2004 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.²¹⁷

ONI stated in 2004 that:

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.²¹⁸

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 propelled-warhead mines in deep waters has the potential to deny enemy naval formations large operational areas.²¹⁹

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.”²²⁰

²¹⁶ Gabriel Collins, Andrew Erickson, Lyle Goldstein, and William Murray, “Chinese Evaluations of the U.S. Navy Submarine Force,” *Naval College War Review*, Winter 2008: 78-79.

²¹⁷ Statement of Lyle J. Goldstein and William Murray as printed in *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, p. 133. See also p. 152.

²¹⁸ 2004 ONI WMC, p. 19.

²¹⁹ 2003 DOD CMP, p. 27.

²²⁰ 2002 DOD CMP, p. 23.

DOD stated in 2000 that:

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.²²¹

Nuclear Weapons. Regarding the potential use of nuclear weapons against U.S. Navy forces, a 2004 study stated 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, China would expect the presence of these weapons and the threat to use them to be a significant deterrent to American action.²²²

Regarding the possibility of China using a high-altitude nuclear detonation to create an EMP effect, DOD stated in 2005 that:

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.²²³

²²¹ 2000 DOD CMP, section on subsurface warfare.

²²² *The Chinese Military, An Emerging Maritime Challenge*, Washington, Lexington Institute, 2004, pp. 13-14.

²²³ 2005 DOD CMP, p. 40.

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).²²⁴ 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.²²⁵ Following the detonation, 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.²²⁶

²²⁴ A report by the Office of Technology Assessment (a congressional support agency that was closed in 1995), stated: "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 at [http://www.wws.princeton.edu/ota/ns20/year_f.html].

²²⁵ 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 stated in 1999 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 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 stated in 2000 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>].)

²²⁶ 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.

High-Power Microwave (HPM) Weapons. Regarding radio-frequency weapons, DOD stated in 2006 that:

Chinese technicians are working to develop several types of “new concept” weapon systems, two of which are radio frequency and laser-based systems.

Long-range beam weapons would use narrow radio frequency (RF) beams to engage targets such as aircraft or precision guided munitions (PGMs). Short-range systems would be packaged into missiles or artillery shells and launched into the vicinity of targets such as radars or command posts before releasing an RF pulse. In recent years, the application of RF weapons has expanded to include deployment on small vehicles or in suitcases for targeting critical military or civilian infrastructures where close access is possible.

PRC officials have publicly indicated their intent to acquire RF weapons as a means of defeating technologically advanced military forces. Chinese writings have suggested that RF weapons could be used against C4ISR, guided missiles, computer networks, electronically-fused mines, aircraft carrier battle groups, and satellites in orbit.

Analysis of Chinese technical literature indicates a major effort is underway to develop the technologies required for RF weapons, including high-power radiofrequency sources, prime-power generators, and antennas to radiate RF pulses.²²⁷

One observer stated in 2005 that “at least one U.S. source indicates the PLA has developed” non-nuclear radio frequency warheads for ballistic missiles.²²⁸ When asked at a hearing in 2005 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 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.²²⁹

²²⁷ 2006 DOD CMP, p. 34.

²²⁸ Prepared statement of Richard D. Fisher, Jr., for a July 27, 2005, hearing before the House Armed Services Committee, 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.

²²⁹ Transcript of spoken testimony of Richard D. Fisher, Jr., at July 27, 2005 hearing before House Armed Services Committee, in response to a question from Representative Curt Weldon.

Aircraft.

Land-Based Aircraft. In addition to the land-based aircraft discussed earlier in this report, China's front-line naval aircraft include, among other models, 110 J-8 Finback fighters (with another 450 or more in the air force); 70 Q-5 (Fantan-A) fighters (a derivative of the J-6 design); 100 J-7 (MiG-21-like) fighters; about 30 H-6D/H-6X (Tu-16 Badger-type) maritime bombers/reconnaissance aircraft; 3 KJ-2000 AWACS aircraft based on the A-50 Mainstay/Il-76 airframe; perhaps 30 older H-5 (Il-28 Beagle-type) maritime strike aircraft; 4 SH-5 amphibious ASW/multipurpose airplanes; and 3 Y-8X maritime patrol aircraft. One source stated in 2007 that "Xian Aircraft has also begun test flying a new variant of the BADGER, designated H-6K. Redesigned to accommodate Russian DA-30 turbo fans, the aircraft has been seen with six pylons for air-launched anti-ship missiles. If tests go well, the fuel economy of the DA-30 and greater reliability will likely result in the replacement of all H-6D aircraft."²³⁰

Regarding land-based aircraft, DOD stated in 2007:

China has more than 700 combat aircraft based within an un-refueled operational range of Taiwan and the airfield capacity to expand that number significantly. Many aircraft in the PLA force structure are upgrades of older models (e.g., re-engined B-6 bombers for extended ranges); however, newer aircraft make up a growing percentage of the inventory.

— The PLA Air Force (PLAAF) is deploying the F-10 multi-role fighter to operational units. The F-10, a fourth generation aircraft, will be China's premier fighter in the coming decades.

— China is now producing the multi-role Su-27SMK/FLANKER (F-11A) fighter under a licensed co-production agreement with Russia following an initial production run of Su-27SKs (F-11). China is employing increasing numbers of the multi-role Su-30MKK/FLANKER fighter-bomber and its naval variant, the Su-30MK2.

— Chinese aircraft are armed with an increasingly sophisticated array of air-to-air and air-to-surface weapons, satellite and laser-guided precision munitions, and cruise missiles....

— Improvements to the FB-7 fighter program will enable this older aircraft to perform nighttime maritime strike operations and use improved weapons such as the Kh-31P (AS-17) anti-radiation missile and KAB-500 laser-guided munitions.²³¹

DOD also stated in 2007 that:

PLA air defense has shifted from point defense of key military, industrial, and political targets to a new Joint Anti-Air Raid Campaign based on a modern, integrated air defense system and offensive and defensive counter-air operations.

²³⁰ Keith Jacobs, "PLA-Navy Update," *Naval Forces*, No. 1, 2007: 30.

²³¹ 2007 DOD CMP, p. 4.

These operations extend beyond the defense of Chinese airspace to include strikes against an adversary's bases (including aircraft carriers) and logistics to degrade the adversary's ability to conduct air operations.

The air defense component of anti-access/area-denial includes SAMs such as the SA-10, SA-20, HQ-9, HQ-15, and extended-range C2 suites such as the S-300PMU2. Beijing will also use Russian-built and domestic fourth-generation aircraft (e.g., Su-27 and Su-30 FLANKER variants, and the indigenous F-10). The PLA Navy would employ recently acquired Russian Su-30MK2 fighters, armed with AS-17/Kh-31A anti-ship missiles. The acquisition of refueling aircraft, including the Russian IL-78/MIDAS and the indigenously developed B-6U refueling aircraft, will extend operational ranges for PLAAF and PLA Navy strike aircraft armed with precision munitions, thereby increasing the threat to surface and air forces distant from China's coast. Additionally, acquisition of UAVs and UCAVs, including the Israeli HARPY, expands China's options for long-range reconnaissance and strike.²³²

Another observer stated in 2007:

Although the modernization of the PLA Air Force has taken a backseat to nuclear, space, and naval development, the PLAAF is a much more modern fighting force in 2007 than it was in 1997. It now boasts about 450 advanced fighter aircraft, including about 300 Russian-designed fourth-generation Su-27 Flankers and Chinese Jian-11s and 76 Su-30MKK fighter-bombers, which display substantial ground attack capabilities and are armed with Russia's most advanced air-to-air missiles.

In January 2007, the PLAAF unveiled its new Jian-10 multirole fighter jet, which is based on the Israeli Lavi airframe, itself an evolutionary offshoot of the F-16. As of March 2007, the PLAAF had reportedly deployed 60 Jian-10s, with the total production run estimated at around 250. Although its forward-wing canards are a novelty among Chinese-designed fighters, the Jian-10's most remarkable characteristic is its midair refueling module. The PLAAF has been practicing in-flight refueling since at least 2005 with both Su-27 and older Jian-8 fighters. Following Peace Mission 2005, a joint Chinese — Russian military exercise on China's Shandong peninsula, China contracted for six to 10 Ilyushin-78s configured as aerial refueling platforms and 30 Ilyushin-76 cargo aircraft configured for paratroop drops.

The increasing size of China's fourth-generation fighter fleet, which is heavily armed with the latest Russian and Chinese air-to-air missiles and equipped with fire control systems and refueling modules, gives the PLAAF a technological and numerical edge in the Taiwan Strait.²³³

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

²³² 2007 DOD CMP, p. 18.

²³³ John J. Tkacik, Jr., *China's Quest for a Superpower Military*, Heritage Foundation Backgrounder No. 2036, May 17, 2007, pp. 13-14.

Jin-class (Type 094) SSBN. China is building a new class of SSBN known as the Jin class or Type 094. The first is expected to become operational as a submarine in mid-2007 and as an SSBN in 2008-2009, depending on progress with the new JL-2 (submarine-launched ballistic) missile.²³⁴ Additional units are expected, perhaps at two-year intervals. A total of four or five is expected.²³⁵ The Jin-class design may be derived from the Shang-class (Type 093) SSN design discussed below.

One observer stated in 2007:

The future mission of the missile submarines appears to be regional because the range of the missiles and operational constraints facing the submarines limit the targets that can be held at risk. The range of the Julang-2 is estimated by the US intelligence community at more than 8,000 km (4,970+ miles), which brings Hawaii and Alaska (but not the continental United States) within reach from Chinese territorial waters. Assuming they made it out of port past lurking U.S. attack submarines, the Chinese missile submarines would have to sail through the narrow straight between South Korea and Japan into the Sea of Japan for its Julang-2 missiles to be able to strike the Seattle area.

The Bo Hai Bay has been suggested as a possible deployment area for China's missile submarines because it would offer more protection against hostile attack submarines. From the shallow bay, the Julang-2 missiles could be used to target Guam and Alaska, India, Russia, and — at the limit of its range — Hawaii.

There are also rumors - one apparently even with a photo — that China may plan to homeport some of its ballistic missile submarines at the new submarine base under construction at Hainan Island in the South China Sea. The infrastructure includes what appears to be a waterway entrance to an underground facility similar to the underground facility at Jianggezhuang submarine base near Qingdao where the Xia is based. Hainan Island has access to deeper waters than Jianggezhuang, but is also less protected. From Hainan Island the Julang-2 would be within range of Guam, India and most of Russia, but not Hawaii.

The U.S. Navy has assessed that China might build as many as five Jin-class submarines “in order to provide more redundancy and capacity for a near-continuous at-sea SSBN presence,” but is yet unclear whether China plans to develop a near-continuous sea-based deterrent or just a surge capability for deployment in a crisis. If all current ballistic missile boats became fully operational, China could deploy a maximum of 36 warheads at sea, although at least one of the boats would probably be in overhaul at any given time. Whatever the future mission, absent any deterrent patrols so far, the Chinese military will first have to learn how to operate the missile submarines in a way that would matter.²³⁶

²³⁴ *Jane's Fighting Ships 2007-2008*, p. 116. See also p. 31 (Executive Overview).

²³⁵ DOD stated in 2008 that up to five might be built. (*2008 DOD CMP*, p. 25.)

²³⁶ Hans M. Kristensen, “Chinese Submarine Patrols Rebound in 2007, but Remain Limited,” *Federation of American Scientists Strategic Security Blog*, available online at

Shang-class (Type 093) SSN. China is building a new class of SSN, called the Shang (or Type 093) class. The boats are viewed as replacements for China's five aging Han-class (Type 091) SSNs, which entered service between 1974 and 1990.²³⁷ (The first Han-class boat was reportedly decommissioned in 2003, and observers expect the other four will be decommissioned as Shang-class boats enter service.²³⁸) DOD stated in 2007 that the first Shang-class SSN began sea trials in 2005.²³⁹ The first was expected to be commissioned in 2006 and the second in 2007; the actual in-service dates for the two boats are expected to be 2007 and 2008. Construction of a third (possibly to a modified design) may have begun, but has not yet been confirmed. A total of five boats is generally expected, but one source stated in 2007 that "[the] Pentagon estimates 3-4 [units] in commission by 2010, with requirements likely to run to eight to ten submarines (providing mostly escort for 'Jin' [class SSBNs] and the 'Xia' No. 406 SSBN.)"²⁴⁰

Observers believe the Shang-class SSNs will likely represent a substantial improvement over the reportedly fairly noisy Han class SSNs. 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 thereby creating what Navy officials described as an antisubmarine warfare (ASW) "crisis" for the U.S. Navy.²⁴¹

Regarding the Jin- and Shang-class programs, one set of observers stated in 2007:

Whereas the Yuan's debut allegedly surprised Western analysts, the emergence of China's [Type] 093 SSN and [Type] 094 SSBN has been anticipated for some time. Nevertheless, these programs remain shrouded in mystery, and there is little consensus regarding their operational and strategic significance. In the broadest terms, it can be said that a successful [Type] 093 program will significantly enlarge the scope of Chinese submarine operations,

[http://www.fas.org/blog/ssp/2008/01/chinese_submarine_patrols_rebo.php].

²³⁷ *Jane's Fighting Ships 2007-2008*, p. 31 (Executive Overview).

²³⁸ Another source paints a somewhat different picture of plans for the Han class, stating: "[The] Type 091/09 (Han) [class boat with the hull number] #403 underwent modernization and overhaul during 2003-04, including [an] 8m hull extension possibly to accommodate [a] new towed passive array, [a] new bow sonar, plus [the] ability to fire Ying-ji-82 ASuW [anti-surface warfare] torpedoes. Others are expected to be modernized in similar fashion. #401 is non-operational, [and] maybe [it will be] next scheduled for re-build and modernisation beginning 2007." (Keith Jacobs, "PLA-Navy Update," *Naval Forces*, No. 1, 2007:24.)

²³⁹ *2007 DOD CMP*, p. 3.

²⁴⁰ Keith Jacobs, "PLA-Navy Update," *Naval Forces*, No. 1, 2007: 20.

²⁴¹ See, for example, Ronald O'Rourke, "Maintaining the Edge in US ASW," *Navy International*, July/August 1988, pp. 348-354.

perhaps ultimately serving as the cornerstone of a genuine blue-water navy. The [Type] 094 could take the survivability of China's nuclear deterrent to a new level, potentially enabling more aggressive posturing by Beijing in a crisis. Moreover, these platforms are entering the PLA Navy (PLAN) at a time when reductions are projected to occur in the U.S. Navy submarine force; that fact was duly noted by a senior PLAN strategist recently in one of China's premier naval journals.²⁴²

These observers also stated in 2007 that:

Chinese sources universally recognize that noise reduction is one of the greatest challenges in building an effective nuclear submarine. PRC scientists have long been conducting research concerning the fundamental sources of propeller noise. For instance, experts at China Ship Scientific Research Center developed a relatively advanced guide-vane propeller by the late 1990s. This, and the fact that China already has advanced seven-blade propellers with cruciform vortex dissipaters on its indigenous Song-class and imported Kilo-class diesel submarines, suggests that the [Type] 093 and [Type] 094 will have significantly improved propellers. A researcher in Qingdao's 4808 Factory also demonstrates Chinese attention to the need to use sound-isolation couplings to prevent transmission of vibrations to the ocean from major fresh-water circulating pumps in the steam cycle. Advanced composite materials are credited with capability to absorb vibrations and sound.

One Chinese researcher states that the [Type] 093 is not as quiet as the U.S. Seawolf class or Virginia class but is on a par with the improved Los Angeles class. Another analyst estimates that the [Type] 093's noise level has been reduced to that of the Russian Akula-class submarine at 110 decibels. He states that the [Type] 094's acoustic signature has been reduced to 120 decibels. According to this report, this is definitely not equal to that of the Ohio class, but is on a par with the Los Angeles. There is no additional information given to evaluate concerning the origins or comparability of these "data."²⁴³

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 eight boats were delivered in 2004-2006. The eight Kilos are believed to be armed with wire-guided and wake-homing torpedoes, and with the Russian-made SS-N-27 Sizzler ASCM, also known as the Novator Alfa Klub 3M-54E — a highly capable 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

²⁴² Andrew S. Erickson and Lyle J. Goldstein, "China's Future Submarine Force: Insights From Chinese Writings," *Naval War College Review*, Winter 2007: 55-56.

²⁴³ Andrew S. Erickson and Lyle J. Goldstein, "China's Future Submarine Force: Insights From Chinese Writings," *Naval War College Review*, Winter 2007: 67.

combatants). The four Kilos commissioned in 1995-1999 are expected to be refitted in Russia; upgrades could include installation of the SS-N-27 ASCM. One source stated in 2007 that the boats might also be fitted at some point with the Russian-made Shkval supercavitating, high-speed (200-knot) torpedo.²⁴⁴

Yuan-class (Type 041) 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,²⁴⁵ was launched (i.e., put into the water for the final stage of construction) in 2004. Observers expect the first Yuan-class boat to enter service in 2006 and the second to enter service in 2009. One source stated in 2007 that in addition to the first two units in the class, “two further units are currently building at Wuhan [Shipbuilding Industry Co.]. By 2010, boats No. 9 & 10 will likely commission. Twenty of [the] class are expected to be built and [the] Jiangnan Shipyard (Shanghai) is expected to be integrated into [the] programme during 2006 with completion of [the] last ‘Song-II’ class.”²⁴⁶

Some observers believe the Yuan class is a variant of the Song (Type 039) class design and consequently refer to the Yuan class as the Type 039A. One observer stated in 2007:

There are few details at present but the design appears to exhibit some features of the Song class, although it appears to be shorter and broader, and possibly also of the Russian Kilo class. The design of the fin [i.e., the “conning tower”] is similar to that of the former while a distinctive ‘hump’ on top of a teardrop shaped hull is characteristic of the latter. It is possible therefore that the boat is of double-hulled construction. Fitted with a seven-bladed propeller. It is not known whether an AIP system has been incorporated.²⁴⁷

Song-class (Type 039/039G) SS. China in recent years also built 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 13 were in service by 2006. Further ships in the class are not expected. 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 set of observers stated in 2005:

The design and production rates of China’s new Song-class diesel submarine represent a significant advance over its predecessor, the Ming-class

²⁴⁴ In discussing the weapons to be carried by China’s Kilos, this source stated in 2007 that “China in late-2005 also firmed contracts” for Shkval torpedoes, and that “The Russians viewed it as a ‘last ditch’ weapon for use against either ships or submarines.” (Keith Jacobs, “PLA-Navy Update,” *Naval Forces*, No. 1, 2007: 21.)

²⁴⁵ *Jane’s Fighting Ships 2005-2006*, for example, stated: “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.

²⁴⁶ Keith Jacobs, “PLA-Navy Update,” *Naval Forces*, No. 1, 2007: 20.

²⁴⁷ *Jane’s Fighting Ships 2007-2008*, p. 118.

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.²⁴⁸

Older Ming-class (Type 035) and Romeo-class (Type 033) SSs.

China in 2007 also had about 19 older Ming (Type 035) class SSs and about 8 even-older remaining Romeo (Type 033) class SSs. The Romeos are expected to be decommissioned soon.

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 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 ship was repaired and returned to service in 2004.

China's Romeo-class boats entered service between the early 1960s and the late 1980s. A total of 84 were built. Of the eight still in service as of 2007, one is a modified boat that has been used as a cruise missile test ship. With the possible exception of this missile test ship, the remaining Romeos are expected to be decommissioned soon.

If China decides that Ming-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. Regarding China's activities for developing an aircraft carrier, one observer stated in 2007 that:

For over a year, the PLAN has been more or less open about China's eventual deployment of an aircraft carrier battle group. Except for the carrier, China has all the elements of a carrier battle group in place, according to Lieutenant General Wang Zhiyuan of the PLA General Armaments Department. China will finish constructing its first aircraft carrier by 2010, according to an unnamed lieutenant general (probably General Wang again), but its first operational carrier will likely be the Varyag, the former Soviet carrier bought from Ukraine.

China's once-secret naval aviation program appears to be underway at full steam. At its center is the massive 67,000-ton former Ukrainian aircraft carrier, which the Chinese government extracted from the Black Sea in 2001 after considerable costs in both treasure and political capital with Turkey. In March 2002, the Varyag finally completed its 15,200-mile journey to its new home port of Dalian, where it was immediately placed under heavy security at the PLAN dry docks.

²⁴⁸ 2005 RAND report, p. 148.

China has reportedly negotiated a contract for 48 Sukhoi-33 jet fighters, the carrier-based version of the Su-27, and is now preparing the Varyag's flight deck for flight operations. Reports in the PRC media indicate that China will also configure its new Jian-10 fighter for carrier operations.

The PLAN Air Force (PLANAF) schedule apparently envisions developing a carrier air wing by the time China launches its own aircraft carrier, despite official Beijing's continuing protestations that while "China already is capable of building an aircraft carrier, a final decision on construction has not yet been made."²⁴⁹

Another observer stated in 2006:

The year 2005 marked a turning point in China's willingness to continue to deny or obfuscate its ambitions to build aircraft carriers. Last May it moved the old Russian uncompleted aircraft carrier hulk the Varyag, that it purchased and moved to Dalian harbor in 2002, from dockside into a drydock. It then emerged in early August painted in PLA Navy grey, and the most recent Internet-source photos show that the carrier deck is receiving new multiple coatings. China's ruse was that the Varyag would be turned into a casino and Chinese officials have repeatedly denied they were developing carriers. But on March 10, Hong Kong's Wen Wei Po quoted General Wang Zhiyuan, a Deputy Director of the Science and Technology Committee of the General Armaments Department, that in "three to five years," "The Chinese army will conduct research and build an aircraft carrier and develop our own aircraft carrier fleet." He went on to add that the escort and support ships for this carrier group are either being built or have already been built. These would likely include the new Luyang 1, Luyang 2 and Luzhou class air defense destroyers launched from 2003 to 2005, new Type 093 nuclear powered attack submarines, and new Fuchi class underway replenishment ships.

If General Wang is to be believed, then the carrier Varyag, now undergoing what appears to be substantial refurbishment, will be used for some kind of military mission. These could include the refinement of China's anti-aircraft carrier doctrine and tactics, training and development of a new carrier air wing, and future aerial and amphibious support combat missions. In August 2005 Russian sources interviewed at the Moscow Airshow offered confirmation of China's carrier plans in that two Russian companies offered that China was interested in two types of future carrier combat aircraft, the Sukhoi Su-33 and the Chengdu J-10 modified with a new Russian engine thrust vector to enable slower carrier landing speeds. The Russians also used the Moscow Airshow to market the twin-seat Su-33UB, but modified with thrust vector engines. It is quite likely that all three will be upgraded with new more powerful Russian Al-31 engines, have new active-phased array radar, and carry a range of active guided and helmet display sighted air-to-air missiles and precision ground attack missiles. As such both could offer some performance parameters that equal or even exceed that of the U.S. Boeing F/A-18E/F, the main U.S. carrier combat aircraft. Internet sources also indicate that China is developing a carrier-sized AWACS aircraft that could also be developed into antisubmarine and cargo support variants. While the U.S. Navy benefits from its over 70 years of constant

²⁴⁹ John J. Tkacik, Jr., *China's Quest for a Superpower Military*, Heritage Foundation Backgrounder No. 2036, May 17, 2007, pp. 12-13.

practice and employment of effective carrier aviation, it is nonetheless a major shock that China's carrier fleet could commence with combat capabilities that could neutralize those of the U.S. Navy in some scenarios.²⁵⁰

Another set of observers stated in 2005 that China's increased shipbuilding capacity:

has direct implications for China's ability to build an aircraft carrier.... China now has eight yards capable of VLCC and ULCC²⁵¹ 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.²⁵²

Surface Combatants.

Luhai (Type 051B) Destroyer. One set of observers stated in 2005 that:

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

²⁵⁰ Prepared statement of Richard D. Fisher, Jr., for a March 16, 2006, hearing before the U.S.-China Economic and Security Review Commission hearing, pp. 5-6. See also David Lague, "An Aircraft Carrier For China?" *International Herald-Tribune*, January 31, 2006; Norman Friedman, "Varyag Redux?" *U.S. Naval Institute Proceedings*, December 2005: 91.

²⁵¹ VLCCs (very large crude carriers) and ULCCs (ultra-large crude carriers) are the two largest kinds of commercial crude oil tankers.

²⁵² 2005 RAND report, pp. 149-150.

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.²⁵³

Luyang I (Type 052 B) and II (Type 052C) Destroyers. One set of observers stated in 2005 that the Luyang I and II classes

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

²⁵³ 2005 RAND report, pp. 144-145.

Chinese SAMs in the stern, would give the Chinese their first fleet air-defense vessels.²⁵⁴

Regarding the radar to be carried by the Luyang II class, a January 2006 press article stated, “The two Chinese Project 052C destroyers have fixed array radars that are often described as active arrays, though that cannot be certain.”²⁵⁵ 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.

Jiangkai I (Type 054) Frigates. One set of observers stated in 2005 that the Jiangkai I-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 Lafayette-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.²⁵⁶

Jiangkai II (Type 054A) Frigates. One source stated in 2007 that:

This [[ast] year [i.e., 2007], we have seen that all 4 initial [Type] 054A [frigates] have been launched and commissioned. Sadly, we did not see a second batch of 054A. Although it’s not as talked about, [the] Huangpu [HP] shipyard also had a huge expansion this past year. While the dock was being used for [building Type 022 fast attack craft] and the ocean tugging ship, [the] 054A [program] was put on the back burners. I guess that showed the important [importance] of these auxiliary ships, but also that PLAN wanted to test these new ships out before building the second batch. With the Huangpu expansion, we might see more 054 series [frigates] coming out in the future in [the] HP [shipyard rather] than [the] HD [shipyard]. I would imagine that [the] 054A [design] will begin construction again at both HD and HP next year. We might see another 4 built next year.²⁵⁷

Another source stated:

A French source confirmed reports that as part of its license production agreement, China has recently declared that it produced 24 SEMT Pielstick diesel engines to support the production of six 3,500 ton Type 054A frigates;

²⁵⁴ 2005 RAND report, pp. 146-147.

²⁵⁵ Norman Friedman, “A New Role For Active Radar Arrays?” *U.S. Naval Institute Proceedings*, January 2006: 91.

²⁵⁶ 2005 RAND report, p. 147.

²⁵⁷ “PLAN looking forward to 2008,” a December 23, 2007, entry in a blog on China naval and air power maintained by an author called “Feng,” available online at [<http://china-pla.blogspot.com/2007/12/plan-looking-forward-to-2008.html>]

each ship uses four of the diesels. This same French source was quite sure that there would be a second production batch of 24 to support a second production run for a total of 12 Type 054A frigates. So far three Type 054A frigates have been launched since late 2006 from two shipyards, Hudong in Shanghai and Huangpu in Guangzhou, with the fourth just launched by Hudong on May 23[, 2007]. At this rate it is possible that all 12 Type 054As will be built by the end of 2009. The Type 054A marks a significant upgrade over the two Type 054 frigates launched in 2003, in that the former is outfitted with 32 new vertical-launched versions of the 45km range Russian Altair Shtil-1.²⁵⁸

This source also stated:

According to the French and German sources interviewed at IMDEX, the PLAN is developing a new class of frigate to accompany the Type 054A air defense frigate now in series production. There was apparently a competition between the engines of the French firm SEMT Pielstick and Germany's MTU, to provide the new diesel engine which will be paired with a gas turbine. MTU won. The new frigate will use two diesels and two turbines, a conventional configuration that could support a range of mission requirements. But the sources interviewed had no insights regarding the size, mission and configuration for this new ship.²⁵⁹

Amphibious Ships.

Type 071 Amphibious Ship. Regarding the Type 071 amphibious ship, one observer stated in 2007:

After several years' speculation, the existence of the [Type 071] programme was confirmed when construction of a ship was initiated in mid-2006. The programme constitutes a key component of the PLA(N)'s plan to improve its sealift and power projection capabilities. Further ships are expected....

The principal features of the ship include a large well deck area to accommodate four Air Cushion Vehicles (ACV) in the aft two-thirds of the ship. The ACVs are likely to access the ship through a stern gate. The ship may have to ballast down for operation. There is a large stern helicopter flight deck and a hangar. An internal garage deck for vehicles may be accessed via side ramps (port and starboard). There is space for the HQ7 launcher which may be fitted at a later date....

This ship represents a major enhancement of amphibious capability.²⁶⁰

²⁵⁸ Richard Fisher, Jr., "Chinese Aspects of Singapore's IMDEX Naval Technology Show," online article available at [http://www.strategycenter.net/printVersion/print_pub.asp?pubID=163] IMDEX refers to a naval technology show held in Singapore.

²⁵⁹ Richard Fisher, Jr., "Chinese Aspects of Singapore's IMDEX Naval Technology Show," online article available at [http://www.strategycenter.net/printVersion/print_pub.asp?pubID=163]

²⁶⁰ *Jane's Fighting Ships 2007-2008*, p. 139.

Another observer stated in 2007:

On December 20, 2006, China launched the PLAN's largest combat amphibious assault ship, an indigenously designed amphibious landing dock (LPD) identified as the Type 071, which is similar to but a little bigger than the U.S. Whidbey Island-class LPD.²⁶¹ Designed in the 10th five-year plan (2001-2005), the ship was built in about six months in the second half of 2006 and appears to be the first of four LPDs. The Type 071 appears to be designed to land 500-800 troops and 25-50 armored vehicles and supplies using 15 landing craft or several large hovercraft. It will carry at least two Changhe Z-8 helicopters, each capable of transporting 30 soldiers inland beyond the beachhead.²⁶²

Potential Type 081 Amphibious Ship. Regarding the potential Type 081 amphibious ship, one source stated in 2007:

At the May 2007 IMDEX naval technology show in Singapore, a Chinese industry source confirmed to *Jane's* that China has a programme for a LHD [i.e., a large amphibious assault ship], but did not disclose details other than to note: "We can now build that ship."

However, late 2006 reports in India's *Force* magazine noted that China would build up to three Type 081 LHD ships and six Type 071 LPD vessels, the first of which was launched in late December 2006. One Asian military source has told *Jane's* that the flat-deck Type 081 will displace about 20,000 tonnes, and as such, would be similar in size to the French Mistral LHD.²⁶³

There have been no reports so far that China has starting building LHDs. China's interest in LHDs has been noted since the late 1990s and would form a logical compliment to its Type 071 LPDs. Asian military sources put the Type 071 also at about 20,000 tonnes displacement with a capacity to carry up to 800 troops plus scores of armoured vehicles. One Asian military source tells *Jane's* that China could build two to eight Type 071s.²⁶⁴

Another source stated in 2007:

The most visible new class [of amphibious ships] is obviously the 071 LPD. We've seen the first one joining service in SSF [the South Sea Fleet] as [hull number] 998. We've yet to see work on a second unit. We know that [the] Dalian [shipyard] and [the] HD shipyard both competed for the first 071 contract with HD winning. It kind of made sense, because HD generally builds ships faster. I believe we will see another unit of 071 being built next year [i.e., in 2008] and that will be done at Dalian. At the same time, HD will probably start construction of China's first LHD. We've talked about the challenges surrounding a Chinese

²⁶¹ This is a reference to the U.S. Navy's Whidbey Island (LSD-41) class amphibious ships, which have a full load displacement of about 15,800 tons.

²⁶² John J. Tkacik, Jr., *China's Quest for a Superpower Military*, Heritage Foundation Backgrounder No. 2036, May 17, 2007, p. 131.

²⁶³ A 20,000-ton LHD would also be about half the size of U.S. Navy LHDs.

²⁶⁴ Richard D. Fisher Jr., "Naval Gazing, Emerging Expeditionary Capabilities in the Western Pacific," *Jane's Intelligence Review*, August 2007: 55.

LHD in the past, but there does seem to be enough political and military will at this point for a unit of this class.²⁶⁵

Other Amphibious Ships and Craft. In addition to Type 071 and Type 081 class amphibious ships, the three other new classes of smaller amphibious ships and craft that entered service between 2003 and 2005 are as follows:

- **Yuting II-class helicopter-capable tank landing ships (LSTs).** Three of these 4,800-ton ships entered service in 2003, another six in 2004, and a 10th in 2005. 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 observers believe additional units might be built.
- **Yunshu-class landing ships (LSMs).** Ten of these 1,850-ton 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 observers believe additional units might be built.
- **Yubei-class utility landing craft (LCUs).** Eight of these landing craft entered service in 2004 and another two in 2005. Each craft can transport 10 tanks and 150 soldiers. The ships were built at four shipyards, and observers expect additional units.

China also has numerous older landing ships and craft of various designs, including 10 Yuting I (Type 072 IV) class helicopter-capable tank landing ships displacing 4,800 tons each that entered service between 1992 and 2002.

DOD stated in 2006 that:

The PLA has increased amphibious ship production to address its lift deficiencies; however, the Intelligence Community believes these increases alone will be inadequate to meet requirements. The PLA is also organizing its civilian merchant fleet and militia, which, given adequate notification, could augment organic lift in amphibious operations. Transport increases were accompanied by an increase of 25,000 troops, 200 tanks and 2,300 artillery pieces in the military regions opposite Taiwan, according to the latest figures from DIA. The increased troops and equipment in these military regions all appear capable of participating in expeditionary operations.²⁶⁶

Another observer stated in 2007 that:

The surface fleet highlight of the last year was the launch on 21 December 2006 of a 17,000 ton Type 071 [amphibious] assault ship (LPD) at Hudong-Zhongua Shipyard, Shanghai. The construction of such a vessel had been

²⁶⁵ “PLAN looking forward to 2008,” a December 23, 2007, entry in a blog on China naval and air power maintained by an author called “Feng,” available online at [<http://china-pla.blogspot.com/2007/12/plan-looking-forward-to-2008.html>].

²⁶⁶ 2006 DOD CMP, p. 30.

anticipated for several years as the logical next-step in the modernisation of amphibious forces. The new ship, and expected follow-on units, is intended to overcome shortcomings in command and control and rapid cross-beach movement that have constrained amphibious capability. This despite the introduction into service of three new classes of landing craft, comprising 30 ships, since 2003. The principal methods of landing troops from the LPD are to be by heavy helicopters and by air-cushion vehicles, four of which can be accommodated. The ship is unlikely to be commissioned until 2008 and, thereafter, a long period of trials can be expected as the Chinese Navy evaluates and learns to operate in its first major [amphibious] unit.²⁶⁷

²⁶⁷ *Jane's Fighting Ships 2007-2008*, p. 31 (Executive Overview).