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China's Foreign Conventional Arms Acquisitions: Background and Analysis

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China's Foreign Conventional Arms Acquisitions: Background and Analysis

Summary

This report examines the major, foreign conventional weapon systems that China has acquired or has committed to acquire since 1990, with particular attention to implications for U.S. security concerns. It is not the assumption of this report that China's military, the People's Liberation Army (PLA), will engage in conflict with other forces in Asia. Nonetheless, since the mid-1990s, there has been increasing concern about China's assertiveness in Asia and greater threats against Taiwan.

Since 1990, China has acquired or sought to acquire select types and modest quantities of modern foreign weapons, primarily from Russia. These include: Mi-17 helicopters, Il-76 transports, Su-27 fighters, S-300 surface-to-air missile (SAM) systems, Kilo submarines, Tor-M1 SAM systems, Sovremenny destroyers (armed with the Sunburn anti-ship cruise missile (ASCM)), airborne early warning (AEW) aircraft (not yet delivered), and Su-30 fighters (not yet delivered).

The Su-27 represents a significant upgrade in fighter aircraft capability over China's indigenous aircraft. The combination of the PLA's imported AA-11 air-to-air missile and highly maneuverable aircraft could prove a vexing air-to-air challenge to modern fighter aircraft of other forces in Asia. The Russian SAMs acquired by China – the SA-15 and especially the SA-10 – represent marked improvements in China's ability to target aircraft and missiles that threaten its airspace. Nonetheless, the PLA's ability to employ its modern acquisitions is hampered by factors such as limited inventory, deficient maintenance, inadequate pilot training, outdated air doctrine, rigid command, disparate communications, and lack of supporting capabilities (i.e., aerial refueling, AEW, and electronic warfare aircraft).

China's navy has been primarily a coastal defense force built around ships based largely on older or obsolete Soviet technology. China's two Sovremenny-class ships would be considerably more technologically modern, complex, and capable than most other PLA surface combatants. The SS-N-22/Sunburn anti-ship cruise missile, designed to defeat the U.S. Navy's Aegis air-defense system, is considered by many to be the most threatening ship-launched ASCM in service today. Still, China's Sovremenny-class ships, though fairly capable, would be vulnerable to air and submarine attack. Although much attention has been paid to China's procurement of Sovremenny-class ships armed with SS-N-22s, the four quiet Kilos, with their potential for avoiding detection and their potent torpedoes, might represent a greater threat to naval forces in Asia. If well-maintained and proficiently-operated, the PLA Navy's Kilo-class submarines can launch attacks against ships and submarines operating in the region. Kilos are, nevertheless, vulnerable to detection and attack.

China has made some significant qualitative upgrades through foreign acquisitions, but it remains to be seen how these acquisitions will be expanded and linked to other PLA improvements. The operational significance of China's conventional arms acquisitions will also depend on the PLA's training to eventually conduct effective joint military operations and the scenario in which the systems might be used. These developments in PLA modernization will bear watching.

Contents

List of Tables

China's Foreign Conventional Arms Acquisitions: Background and Analysis

Purpose and Scope[1]

Congressional Concerns

This CRS Report examines the foreign conventional arms acquisitions of China's military, collectively called the People's Liberation Army (PLA).[2] The purpose of this report is to provide information to Congress, using best available unclassified data, on the PLA's arms procurement, with assessments of implications for regional security – particularly, U.S. security concerns.

It is not the assumption of this report that the People's Republic of China (PRC) will engage in conflict with other forces in Asia. This report does not examine the likelihood or nature of a crisis or conflict that might involve PLA, other Asian, and/or U.S. forces.

Nonetheless, since the mid-1990s, there has been increasing concern about the PRC's assertiveness in the Asian-Pacific region as well as threats against Taiwan and possible third-party military involvement in the Taiwan Strait. As the Secretary of Defense reported in June 2000, the PLA operates under the doctrine of "fighting local wars under high-tech conditions," calling for rapid response by select pockets of excellence within the PLA to a range of contingencies along China's land and sea borders. Particularly, "China expects to encounter a more technologically advanced foe, such as the United States or Japan, if conflicts concerning its interests within this strategic envelope arise. Moreover, a cross-Strait conflict between China and Taiwan involving the United States has emerged as the dominant scenario guiding PLA force planning, military training, and war preparation."[3]

Since the 1990s, Members of Congress have increasingly expressed concerns about the efforts of the PRC to modernize the PLA. While many countries upgrade their militaries, the PLA's modernization has prompted a debate about the extent to which enhanced PLA capabilities challenge U.S. interests and stability in the Asia-

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[1] Prepared by Shirley A. Kan, Specialist in National Security Policy.

[2] The "PLA" refers to all services and branches, including ground, air, and naval forces, and the missile force (the Second Artillery).

[3] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000. According to the report, about 14 of perhaps 40 divisions [or approximately one-third] in the PLA ground forces are considered "rapid reaction units."

Pacific region. This debate has covered several areas of concern, including the expanding PRC presence in the disputed South China Sea, the greater PLA missile threat to Taiwan as demonstrated by the missile "test-firings" in 1995 and 1996, persistent threats to use force in the Taiwan Strait, suspected unauthorized acquisitions of U.S. missile technology (from satellite launches) and nuclear weapon secrets, weapons proliferation, and rising arms purchases (particularly from Russia).

Some Members have cited the Taiwan Relations Act (TRA), P.L. 96-8, as a basis for congressional concern over the situation in the Taiwan Strait. The TRA left the question of U.S. involvement somewhat ambiguous. Section 2(b)(4) states that the United States will consider with "grave concern" any non-peaceful means to determine Taiwan's future. Nonetheless, in not wanting to pre-determine U.S. actions, Members of Congress also adopted section 2(b)(6), declaring it to be U.S. policy "to maintain the capacity of the United States to resist any resort to force or other forms of coercion that would jeopardize the security, or the social or economic system, of the people on Taiwan."[4]

Particularly since the PLA's provocative missile "test-firings" in 1995 and 1996, and U.S. deployment of two aircraft carriers close to Taiwan in March 1996, Congress has required reports from the Clinton Administration on the PRC's military capabilities and strategy, and the situation in the Taiwan Strait. The Pentagon has submitted these reports since 1997.[5]

As for legislation, the 106th Congress considered some bills generated by concerns about the PLA's arms purchases, including H.R. 1838 and S. 693 (bills introduced by Rep. Delay and Senator Helms as legislative means to enhance Taiwan's security), and H.R. 4022 and S. 2687 (bills introduced by Rep. Rohrabacher and Sen. Robert Smith banning U.S. forgiveness or rescheduling of debt owned by Russia unless it stops transfers of Sunburn anti-ship cruise missiles to China).

Scope of Report and Other Factors for PLA Modernization

This CRS Report examines the major, foreign conventional weapon systems that the PLA has acquired or has committed to acquire since 1990. Still, it is important to note that there are other factors important to PLA modernization, besides having foreign equipment. Separate CRS reports discuss the PLA's modernization of its missile force (especially the theater ballistic missile buildup against Taiwan), including strategic nuclear-armed missiles and warhead modernization, largely indigenous

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[4] See CRS Report RL30341, *China/Taiwan: Evolution of the "One China" Policy – Key Statements from Washington, Beijing, and Taipei*, by Shirley A. Kan.

[5] Department of Defense, "Selected Military Capabilities of the People's Republic of China (Report to Congress Pursuant to Section 1305 of the FY97 National Defense Authorization Act)," April 1997; "Future Military Capabilities and Strategy of the People's Republic of China (Report to Congress Pursuant to Section 1226 of the FY98 National Defense Authorization Act)," July 1998; "The Security Situation in the Taiwan Strait (Report to Congress Pursuant to the FY99 Appropriations Bill)," February 1999; and "Annual Report on the Military Power of the People's Republic of China (Report to Congress Pursuant to the FY2000 National Defense Authorization Act)," June 2000.

undertakings.[6] Another CRS Report looks at the closer PRC-Russian "strategic partnership."[7]

In parallel with foreign procurement of equipment, the PRC has also sought foreign technology to help its struggling defense industries. An example is reported Russian cooperation in the PRC's development of new submarines, including the Song-class diesel-electric submarine (SS), Type 093 nuclear-powered attack submarine (SSN), and Type 094 nuclear-powered ballistic missile submarine (SSBN).[8] Another example is Israel's reported cooperation with China, perhaps since 1991, in the development of a new F-10 (also called J-10) fighter, based on the Lavi fighter project that was canceled in 1987 and was comparable to the F-16.[9]

In-flight refueling aircraft is a third example of new important capabilities developed by China reportedly with significant foreign assistance. The PLA has sought in-flight refueling capability at least since the 1980s, reportedly from various foreign sources (United Kingdom, Iran, Israel, Pakistan, and Russia).[10] By 1996, a news story cited a classified Pentagon report as saying that China had produced five in-flight refueling tankers, converted from B-6 (H-6) bombers, and planned to have

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[6] CRS Report 97-391, *China: Ballistic and Cruise Missiles*, by Shirley A. Kan; and CRS Report 97-1022, *Chinese Nuclear Testing and Warhead Development*, by Jonathan Medalia.

[7] CRS Report 97-185, *Russian-Chinese Cooperation: Prospects and Implications*, by Stuart D. Goldman and Robert G. Sutter.

[8] Office of Naval Intelligence, *Worldwide Submarine Challenges*, 1997; "Russia Helping China Develop New-Generation Attack SSN, SSBN," *Jianchuan Zhishi [Naval and Merchant Ships]* (Beijing), October 1997, in FBIS; Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[9] Israel's cooperation with the PRC in producing this next-generation fighter has been reported in a number of sources, including: *Kuang Chiao Ching [Wide Angle]* (Hong Kong), December 16, 1991, translated in JPRS-CAR-92-019, April 1, 1992; *Washington Times*, October 13, 1993; *Flight International*, November 2-8, 1994; *Los Angeles Times*, December 28, 1994; *Defense News*, July 21-27, 1997; *Flight International*, October 15-21, 1997; *Flight International*, May 20-26, 1998. As early as 1993, in answering questions from a hearing of the Senate Governmental Affairs Committee, the Director of Central Intelligence (DCI) publicly confirmed that Israel's "long history" of military technical cooperation with China has included work on "China's next generation fighter." More recently, the Office of Naval Intelligence (ONI) issued a report in 1996 that said China has acquired U.S. technology "through Israel in the form of the Lavi fighter." In 1996 and 1997, ONI reported that the F-10's design was based "heavily" on the canceled Israeli Lavi program and has benefitted from "substantial direct external assistance, primarily from Israel and Russia, and with indirect assistance through access to U.S. technologies," according to *Worldwide Challenges to Naval Strike Warfare*.

[10] Andrew Slade, "USA Pushing to Block UK Sale to Chinese," *Jane's Defense Weekly*, September 17, 1988; *Far Eastern Economic Review*, February 21, 1991; Nayan Chanda, "China Poses New Threat to Contested Islands," *Asian Wall Street Journal*, March 23, 1992; Nicholas D. Kristof, "China Obtains Aerial-Refueling Technology," *New York Times*, August 23, 1992; Tai Ming Cheung, "Loaded Weapons," *Far Eastern Economic Review*, September 3, 1992;

at least 20 tankers to support indigenous F-8 fighters (15 of which had been equipped with aerial refueling probes), F-10s, and FB-7 fighters under development.[11] At the October 1, 1999 military parade in Beijing to commemorate the 50th anniversary of the PRC's founding, the PLA's aerial refueling tankers flew publicly for the first time, according to China's official media. China billed the tankers as indigenously produced and said that "gone are the days" when the PLA's aircraft could not be refueled in the air, and what is of "strategic importance is that the flying tankers have boosted the air force's long-range [combat capability]."[12] Nonetheless, reports do not say the PLA can perform aerial refueling of the imported advanced Su-27 fighters, and the Pentagon reported in 2000 that the PLA Air Force's aerial refueling program remains behind schedule.[13]

There are still other considerations that are important to PLA modernization, and PRC leaders appear to recognize that simply having more modern systems does not necessarily mean the PLA would be able to utilize them effectively. PRC leaders have sought to reform, streamline, and restructure the PLA based on high technology and quality (rather than quantity), requirements for the absorption of modern weapons acquired from abroad. The PLA has pursued improvements in non-hardware aspects necessary for modernization, such as professionalization, training, logistics, leadership, maintenance, doctrine, and strategy.[14] In the 1996 exercise involving the three separate services, the PLA showed its intent to eventually have the ability to carry out joint operations.[15] The Secretary of Defense has reported that a possible PLA attack on Taiwan would likely include naval blockades, missile strikes, special operations, air attacks, and airborne and amphibious invasions.[16] Russian training has accompanied the PLA's hardware acquisitions. In October 1999, Russian and PLA

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[11] Bill Gertz, "Chinese Arms Buildup Increases Attack Range," *Washington Times*, March 12, 1996.

[12] "Chinese-Made Aerial Refuellers Debut in Military Parade," *Xinhua* [New China News Agency] (Beijing), October 1, 1999, in FBIS. A PRC-owned newspaper in Hong Kong reported that the refueling tankers were modified H-6 bombers (based on the Soviet Tu-16 bomber) and asserted that "the presence of these tanker planes indicates that China has already mastered the technique" ("Article Reviews China's New Weapons," *Ta Kung Pao* (Hong Kong), October 2, 1999).

[13] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[14] On multifaceted aspects of PLA modernization, see, for example: "Special Issue: China's Military in Transition," *China Quarterly*, June 1996; James R. Lilley and Chuck Downs (editors), *Crisis in the Taiwan Strait* (Washington: American Enterprise Institute and National Defense University Press, 1997); James C. Mulvenon, *Professionalization of the Senior Chinese Officer Corps: Trends and Implications*, Rand, 1997; James C. Mulvenon and Richard H. Yang (editors), *The People's Liberation Army in the Information Age* (Santa Monica, CA: Rand Corporation, 1999); James R. Lilley and David Shambaugh (editors), *China's Military Faces the Future* (Washington: American Enterprise Institute, 1999); Susan M. Puska (editor), *People's Liberation Army After Next* (Army War College, 2000).

[15] Office of Naval Intelligence, *Chinese Exercise, Strait 961: 8-25 March 1996*, 1996.

[16] Secretary of Defense, "The Security Situation in the Taiwan Strait," Report to Congress Pursuant to the FY99 Appropriations Bill, February 1999.

naval forces took the first steps in holding what they called "military exercises" together in the East China Sea near Shanghai.[17] PRC leaders have also tried to curb corruption in the PLA, with President Jiang Zemin's ban on businesses in the PLA (announced in July 1998). In addition, strategic thinkers of the PLA have examined changes in warfighting, including information warfare, the revolution in military affairs (RMA), and asymmetric warfare.[18]

Major Foreign Arms Acquisitions[19]

Objectives of the Middle Kingdom

Leaders in Beijing have pursued a historical quest for a modern China that is prosperous and strong, presuming the country as rightfully the most powerful among Asian countries and one among great powers of the world. Many analysts in and outside government believe that, since economic reforms began in 1979, China's leaders have placed their top priority on economic growth as the requirement for social stability, political control, national unification, and world standing. Nonetheless, Beijing has pursued military modernization as a secondary, but important, component of building comprehensive national strength. China pursues military modernization in order to ensure that it is the preeminent power in Asia so that any significant action undertaken by any other country in Asia must first consider China's interests.[20] Over the last two decades, discussion of China's interests and challenges to regional stability has shifted from its role in the Cold War to domestic repression and instability (e.g., Tiananmen crackdown) to claims over the South China Sea to tensions over Taiwan (and the potential involvement of U.S. and Japanese forces).

Especially since the mid-1990s, China has viewed its top security problem as preventing Taiwan's permanent separation and securing unification as "one China." This focus has catalyzed PLA modernization, including procurement of advanced

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[17] "Russian Navy to Conduct First Joint Exercise with PRC," *Sing Tao Jih Pao* (Hong Kong), in FBIS; "Russia, China to Hold Military Exercises Early Oct," *Voice of Russia* (Moscow), October 1, 1999, in FBIS; "Russian Warships Complete Visit to Shanghai," *RIA* (Moscow), October 6, 1999, in FBIS; "Sino-Russian Naval Exercise Reviewed," *Yazhou Zhoukan* [Asiaweek] (Hong Kong), October 11-17, 1999, in FBIS.

[18] For a study that examined PLA modernization with an emphasis on strategic aspects, such as the targeting of command, control, communications, computers, and intelligence (C4I) systems with missiles and information warfare, see: Mark A. Stokes, *China's Strategic Modernization: Implications for the United States* (Carlisle, PA: Army War College, Strategic Studies Institute, 1999). For some published PLA writings on future warfare, see: Michael Pillsbury (editor), *Chinese Views of Future Warfare* and *China Debates the Future Security Environment* (Washington: National Defense University, Institute for National Strategic Studies, 1997 and 2000).

[19] Prepared by Shirley A. Kan, Specialist in National Security Policy.

[20] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

foreign military equipment. In the longer-term, experts believe that China also aims to preclude Japan's rise as the strongest Asian power, ensure PRC influence over the Korean peninsula, support PRC claims to territory in the East and South China Seas, subdue India's quest for power, and counter American might in the region.

Increasing Foreign Arms Acquisitions since 1990

In the early 1990s, a number of changes in the world contributed to the PRC's renewed arms procurement from the Soviet Union and its successor, Russia – the PLA's source of arms in the 1950s, before the Sino-Soviet split. Israel has been cited as another source of weapons technology, in secondary importance.[21] After the Tiananmen crackdown in June 1989, the United States imposed sanctions that have included a suspension of arms sales to the PRC.[22] Previously, the PRC had looked to the United States for some weapons technology, including a military aircraft modernization program called "Peace Pearl."[23] The rationale for U.S.-PRC cooperation during the Reagan Administration stemmed from the Cold War, the end of which in 1991 removed the strategic basis for U.S. arms sales to China. The dissolution of the Soviet Union and the dire economic situation of Russia also brought Moscow and Beijing together in renewing their arms trade. Initially for domestic security reasons, PRC leaders began to pay greater attention to the PLA, as indicated by double-digit increases in the public defense budget, beginning with a real increase in 1990 that was the first since the early 1980s.[24] Moreover, by the early 1990s, the PRC's economic reforms, expanded foreign trade, and earnings from tourism had spurred significant jumps in its foreign exchange holdings. As an indicator, with about $43 billion in foreign reserves in early 1992, the PRC held the 6th largest foreign exchange reserves in the world, part of which was available for arms.[25]

U.S. victory in the Persian Gulf War of 1991 also altered perceptions of world power relations and dramatically demonstrated to PRC leaders the obsolescence of PLA equipment. PRC leaders quickly learned lessons from that war, driving them to upgrade the PLA for modern warfare.[26] Lastly, after pursuing quiet, unofficial ties

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[21] Bates Gill and Taeho Kim, *China's Arms Acquisitions from Abroad: A Quest for "Superb and Secret Weapons,"* Stockholm International Peace Research Institute Research Report No. 11 (Oxford University Press, 1995).

[22] U.S. sanctions imposed after the Tiananmen crackdown were enacted in section 902 of the Foreign Authorization Act for FYs 1990 and 1991 (P.L. 101-246).

[23] As announced by the State Department on December 22, 1992, the Bush Administration decided to close out the four suspended Foreign Military Sales (FMS) cases, which involved an avionics upgrade for the F-8 fighter, equipment for munitions production, four anti-submarine torpedoes, and two artillery-locating radars.

[24] Central Intelligence Agency, *The Chinese Economy in 1989 and 1990: Trying to Revive Growth While Maintaining Social Stability*, July 1990.

[25] Central Intelligence Agency, *The Chinese Economy in 1991 and 1992: Pressure to Revisit Reform Mounts*, July 1992.

[26] Sheryl WuDunn, "War Astonishes Chinese and Stuns Their Military," *New York Times*, (continued...)

since 1979, reportedly including several billion dollars in defense sales, the PRC and Israel established diplomatic relations in 1992.[27] In short, Beijing had greater motivation, resources, and opportunity to acquire modern arms from abroad.

Thus, in the 1990s, as a result of the turn to major foreign military equipment to modernize the PLA, the PRC ranked among the top ten leading arms buyers among developing nations. As an indicator of its arms purchases from abroad, in the period 1992-1999, China ranked 4th in arms transfer *agreements* with a total value of $10.9 billion, behind Saudi Arabia, Taiwan, and the United Arab Emirates (U.A.E.). In the same 8-year period, China received a total value of $5.9 billion in arms *deliveries*. Russia has been the primary source of China's arms. Estimated values of China's acquisitions, in current U.S. dollars, are shown in Table 1 below.[28]

Table 1. Values of China's Arms Acquisitions

Period	Agreements	Deliveries
1992-1995	$ 7.0 billion	$ 2.8 billion
1996-1999	$ 3.9 billion	$ 3.1 billion
1992-1999	$10.9 billion	$ 5.9 billion

In comparison, some other governments in the developing world acquired more arms than the PRC, which ranked 8th among top recipients. According to the same CRS Report, in the 8-year period, Saudi Arabia (ranking 1st) received $66.1 billion in arms deliveries; and Taiwan (ranking 2nd), $20.6 billion. Table 2 shows China's ranking among the top 10 recipients of arms, excluding developed powers (United States, Russia, European nations, Canada, Japan, Australia, and New Zealand).

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[26] (...continued)
March 20, 1991; "Leaders Reach Consensus on Hi-Tech Development," *Ta Kung Pao* (PRC-owned newspaper in Hong Kong), April 27, 1991; "CPC Leadership on Technological Development," *Wen Wei Po* (PRC-owned newspaper in Hong Kong), May 21, 1991.

[27] Clyde Haberman, "Israeli Aide's Trip Linked to China Ties," *New York Times*, January 9, 1992; DCI Woolsey's answers to questions from a hearing of the Senate Governmental Affairs Committee, "Proliferation Threats of the 1990s," February 24, 1993; Amnon Barzilai, "Bringing Down the Chinese Wall," *Ha'aretz*, February 5, 1999.

[28] CRS Report RL30640, *Conventional Arms Transfers to Developing Nations, 1992-1999*, August 18, 2000, by Richard F. Grimmett.

Table 2. China Among Top 10 Developing Arms Recipients

Rank	Recipient	Value of Deliveries, 1992-1999
1	Saudi Arabia	$66.1 billion
2	Taiwan	$20.6 billion
3	Egypt	$9.7 billion
4	South Korea	$8.8 billion
5	U.A.E.	$7.8 billion
6	Kuwait	$7.6 billion
7	Israel	$7.2 billion
8	**China**	**$5.9 billion**
9	Iran	$4.7 billion
10	Pakistan	$4.2 billion

Major Arms Acquisitions

Since embarking on foreign procurement for steady military modernization in 1990, the PLA has acquired or committed to acquire (with preliminary agreements or contracts) select types and modest quantities of weapon systems, as described below using public sources of information. Table 3 summarizes these major acquisitions. Following this discussion on what the PLA has been acquiring, the next two sections will assess the implications of these acquisitions for upgrading PLA air and naval capabilities and the challenges they may pose for other forces in Asia.

Mi-17 Helicopters. In the first purchase of military equipment from Moscow after the Sino-Soviet split ended with rapprochement in the late 1980s, the PLA purchased 24 Mi-17 transport helicopters for army troops in 1990 and received them by 1991.[29] One source reported that the PLA ordered 30 Mi-17s in 1995 which were delivered by 1997, when the PLA ordered five more, for a total of about 60 Mi-17 helicopters by 1999.[30] The Mi-17s were assigned to the army aviation corps.[31]

[29] *Far Eastern Economic Review*, October 11, 1990; Gill and Kim.

[30] International Institute for Strategic Studies (IISS), *Military Balance 1999-2000*.

[31] Kenneth W. Allen, Glenn Krumel, Jonathan D. Pollack, *China's Air Force Enters the 21st Century*, Rand, 1995.

Table 3. China's Major Conventional Arms Acquisitions Since 1990

Item	Qty.	Year of Sale	Year of Delivery	Value ($ mil)	Comment
Mi-17 helicopters	60	1990-97	1991-99		from Russia
Il-76 transport aircraft	10	1990-92	1991-93		from Russia
Su-27 fighters	26 22 <200	1991 1995 1996	1992 1996 1998-?	1,000 710 2,500	from Russia; armed with AA-10 and AA-11 AAMs; up to 200 (called J-11) to be co-produced under license with Russian help over perhaps 15 years
S-300/SA-10 SAM regiments	4	1991-99	1993-00		from Russia; similar to U.S. Patriot air defense system
Kilo-class submarines	4	1994	1995-98	700	from Russia; 2 Type 877, 2 Type 636
Tor-M1/SA-15 SAM regiments	2	1995-99	1997-00		from Russia
Sovremenny-class destroyers	2	1996	2000	1,000	from Russia; equipped with 3M-80 Moskit (SS-N-22 Sunburn) ASCMs, Uragan (SA-N-7 Gadfly) SAMs, and Ka-27 and Ka-28 ASW helicopters.
A-50 AEW aircraft	1-4	1996	not yet delivered	250-1,000	for PLAAF; modified Russian Il-76; Israeli Phalcon radar canceled in 2000
Su-30 fighters	40	1999	not yet delivered	2,000	from Russia; armaments could include Python-4 AAMs (Israeli), KR-1 anti-radiation AAMs, air-launched Moskit, R-77 (AA-12) AAMs.

Il-76 Transports. Beijing also procured from Moscow three Il-76TD transport aircraft in 1990, and PRC official media confirmed the arrival of the planes in 1991.[32] In 1992, the PLA ordered seven Russian Il-76s in a deal worth $200 million that was paid 40 percent in hard currency and 60 percent in barter goods.[33] Thus, the PLA Air Force is believed to have acquired 10 Il-76 transports by 1993.[34] The Pentagon confirmed that the PLA Air Force has about a dozen Il-76 heavy lift aircraft.[35] The Il-76 transports were assigned to the PLA Air Force's 13th Air Division near Wuhan, Hubei province, to support the airborne troops (15th Airborne Army).[36]

Su-27 Fighters and Armaments. Beijing's first controversial order in the renewed arms procurement relationship with Moscow involved the Su-27, the first fourth-generation fighter for the PLA Air Force. China bought 48 Russian Su-27s.[37]

The PRC and the Soviet Union began high-level negotiations over fighters in 1990,[38] later reported to be for two dozen Su-27 fighters.[39] The Soviets demonstrated several fighters, including the Su-27, in Beijing in March 1991.[40] Beijing signed the contract later in 1991.[41] By 1992, Russia delivered 26 Su-27s, including two for free.[42] Reporting to the United Nations (U.N.), both Russia and China confirmed that it received 26 Russian combat aircraft in 1992, and Russia added that six of them were training aircraft.[43] The two countries also reported a transfer of 144 missiles. These were believed to be AA-10 air-to-air missiles (AAMs) to arm the Su-27s.[44]

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[32] *Xinhua [New China News Agency]*, September 26, 1991, translated in FBIS; *Far Eastern Economic Review*, October 7, 1993.

[33] Tai Ming Cheung, "Arms Reduction," *Far Eastern Economic Review*, October 14, 1993.

[34] IISS, 1999-2000; Gill and Kim.

[35] Secretary of Defense, "The Situation in the Taiwan Strait," Report to Congress Pursuant to the FY99 Appropriations Bill, February 1999; and "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[36] Kenneth W. Allen, Glenn Krumel, Jonathan D. Pollack, *China's Air Force Enters the 21st Century*, Rand, 1995.

[37] Office of Naval Intelligence, "Worldwide Challenges to Naval Strike Warfare," 1996.

[38] "China Seeking Soviet Fighters," *Jane's Defense Weekly*, July 21, 1990; Tai Ming Cheung, "A Sale is in the Air," *Far Eastern Economic Review*, September 6, 1990.

[39] *Tanjug [Yugoslav News Agency]*, November 9, 1990, in FBIS; *Far Eastern Economic Review*, February 14, 1991.

[40] *People's Daily (overseas edition)*, March 15, 1991; *Xinhua*, March 22, 1991; in FBIS.

[41] *Flight International*, April 3-9, 1991; *Far Eastern Economic Review*, May 23, 1991.

[42] *Far Eastern Economic Review*, August 20, 1992, December 17, 1992.

[43] United Nations General Assembly, "United Nations Register of Conventional Arms, Report of the Secretary-General," October 11, 1993.

[44] Gill and Kim.

The value of this first Su-27 package eventually reached about $1 billion, with payment involving 60 percent in hard currency and 40 percent in barter goods.[45]

After showing interest in 1993 in buying a second order of Su-27s, the PRC ordered 22 of the fighters in 1995 in a deal worth about $710 million, with perhaps 50-100 percent in hard currency.[46] In reporting to the U.N., both China and Russia confirmed that the transfer of 22 aircraft took place in 1996.[47]

China's Su-27s, a version called Su-27SKK, reportedly have been based in southeastern China, with the first group at Wuhu, Anhui province (under the Nanjing Military Region), and the second at Suixi, in Guangdong province (under the Guangzhou Military Region).[48] AAMs equipped on the SU-27s include the AA-10/Alamo as well as the AA-11/Archer infrared AAM.[49] The total number of these AAMs cannot be established through open sources.

China's Su-27s are not believed to have an in-flight refueling capability.[50] Moreover, a 1996 press account cited a classified Pentagon report as saying that China's converted B-6 tankers support the indigenous F-8 fighter, and perhaps also the FB-7 and/or F-10 fighters under development, but the report did not mention aerial-refueling of Su-27s.[51]

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[45] *Far Eastern Economic Review*, May 23, 1991; Tai Ming Cheung, "Loaded Weapons," *Far Eastern Economic Review*, September 3, 1992; "'Made in China' Deal is Forged for Su-27s," *Jane's Defense Weekly*, May 6, 1995; Aleksandr Koretskiy, "China Will Be Manufacturing Russian Airplanes on Its Own," *Kommersant Daily* (Moscow), translated by FBIS.

[46] Tai Ming Cheung, "China's Buying Spree," *Far Eastern Economic Review*, July 8, 1993; "'Made in China' Deal is Forged for Su-27s," *Jane's Defense Weekly*, May 6, 1995; "Russian Imports Step in to Fill the Arms Gap," *Jane's Defense Weekly*, December 10, 1997.

[47] U.N. Register of Conventional Arms for 1996; Paul Lewis, "China Receives Su-27 Batch and Discusses Third Order," *Flight International*, October 23-29, 1996.

[48] "China Prepares for Local Production of Sukhois," *Jane's Defense Weekly*, July 16, 1997; Federation of American Scientists ([http://www.fas.org]). The Secretary of Defense said in the June 2000 report that a PLA operation against Taiwan would include air and ground force units under the Nanjing and Guangzhou Military Regions.

[49] Office of Naval Intelligence, *Worldwide Challenges to Naval Strike Warfare*, 1997; Douglas Barrie, "Russia and Israel Prepare for Dogfight Over Chinese Missile," *Flight International*, September 24-30, 1997; Alexander A. Sergounin and Sergey V. Subbotin, "Russian Arms Transfers to East Asia in the 1990s," SIPRI Research Report No. 15 (Oxford University Press, 1999); IISS, *Military Balance 1999-2000*; *Jane's*; Secretary of Defense, "The Security Situation in the Taiwan Strait," Report to Congress Pursuant to the FY99 Appropriations Bill, February 1999.

[50] According to Piotr Butowski, "Dominance by Design: the Reign of Russia's 'Flankers'," *Jane's Intelligence Review*, November 1999, the Su-27, unlike the Su-30, has no standard provision for in-flight refueling.

[51] Bill Gertz, "Chinese Arms Buildup Increases Attack Range," *Washington Times*, March 12, 1996.

As agreed in principle in 1995, Russia consented in 1996 to allow China to co-produce perhaps as many as 200 Su-27s under license, initially consisting of assembly from Russian kits, eventually leading to full production in China over a period of perhaps 15 years.[52] This deal was worth around $2.5 billion, including $450 million for the license to produce and up to $2 billion for co-production.[53] The PRC has designated the PRC version, produced at the Shenyang Aircraft Factory, as the J-11 (or F-11).[54] With the help of over 100 Russian engineers, China assembled the first two kits in 1998 and flight-tested the planes in December 1998, but the aircraft had to be rebuilt afterwards.[55] By 2000, with initial production problems and the schedule falling behind, Russia planned to deliver at least 20 already-assembled Su-27s as part of the deal.[56]

S-300/SA-10 Air Defense Systems. China has sought to upgrade its air defense capability with the purchase of the Russian S-300/SA-10 Grumble area defense system (similar to the U.S. Patriot system). According to a 2000 Pentagon report to Congress, China has procured limited numbers of "state-of-the-art" Russian surface-to-air (SAM) systems, namely, the SA-10b, SA-10c, and SA-15. (Procurement of the SA-15 is discussed below.) The SA-10b (S-300PMU) missile has a range of 90 km (56 mi); the SA-10c (S-300PMU1), 150 km (93 mi).[57] According to the report, these Russian air defense systems provide only a "rudimentary" and "limited" defense against aircraft and cruise missiles, as China tries to further fill the gaps in its air defense structure by building its own systems using purchased technology. Moreover, the assessment said that "China's ground-based air defense forces reportedly can provide no better than point defense; there is no comprehensive, integrated national air defense network."[58]

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[52] *Jane's Defense Weekly*, May 6, 1995; Barbara Opall, "China Mulls Production of Carrier-Based Su-27," *Defense News*, November 18-24, 1996; "China Prepares for Local Production of Sukhois," *Jane's Defense Weekly*, July 16, 1997.

[53] "Russian-Chinese Trade May Triple Due to Energy, Military Links," *Interfax* (Moscow), April 16, 1997; "Russian Imports Step in to Fill the Arms Gap," *Jane's Defense Weekly*, December 10, 1997; Pyotr Yudin, "Russia's Sukhoi Plans Aircraft Technical Center in India," *Defense News*, February 23-March 1, 1998.

[54] *Jane's All the World's Aircraft 2000-2001*.

[55] "Beijing Builds Su-27 Fighters from Russian Kits," *Jane's Defense Weekly*, June 10, 1998; "Test Flights of 1st Domestically Made Su-27 Fighters," *Voice of Russia* (Moscow), December 31, 1998, in FBIS; "China-assembled Su-27s Make Their First Flights," *Jane's Defense Weekly*, February 24, 1999; *Jane's All the World's Aircraft 2000-2001*.

[56] Robert Sae-Liu, "Russia to Make Up China's 'Flanker' Fighter Shortfall," *Jane's Defense Weekly*, June 14, 2000.

[57] *Jane's Land-Based Air Defense 1996-97*.

[58] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000; China's acquisition of the SA-10c is also reported in: Office of Naval Intelligence, *Worldwide Maritime Challenges*, 1997.

By 1998, China reportedly acquired two S-300 regiments (each with perhaps four to six batteries to surround a defensive area) and began negotiations to acquire two more S-300 regiments for other areas.[59] The PRC first purchased four to six S-300PMU batteries in 1991 and acquired them in 1993, with an initial batch of perhaps 60-100 missiles and 120 more missiles in 1994.[60] The PLA Air Force first deployed the long-range S-300 batteries around Beijing to protect this major political and economic site.[61] By 1999, China also reportedly deployed several S-300 batteries to a second area in Fujian province across the strait from Taiwan (at Longtian, near Fuzhou). In addition, the PLA began to prepare for the deployment of additional S-300 batteries at two more areas across the strait from Taiwan (near the coastal cities of Xiamen in Fujian province and Shantou in Guangdong province). The S-300 batteries near Xiamen were expected to be operational in early 2000.[62] While the operational status of the 3rd and 4th S-300 regiments is uncertain, it appears that the PLA Air Force has been acquiring four S-300 regiments (with plans to defend the four areas of Beijing, Longtian, Xiamen, and Shantou).

Public reports do not provide the total number of S-300 launchers or missiles the PLA has deployed. An estimate of the number of S-300 missiles deployed by the PLA Air Force would depend on the number of batteries in each regiment and the number of launchers in each battery. Each S-300 system consists of a towed launcher with four launch tubes (towed by a heavy wheeled tractor) or a mobile launcher (a transporter-erector-launcher (TEL)) with four launch tubes to fire reloadable missiles.[63] One S-300 regiment has several batteries, and the regimental command post can control up to six batteries. A typical S-300 battery consists of up to four launchers, a command and control vehicle, a radar vehicle, additional missiles for reloads, and maintenance equipment.[64] The PLA's initial procurement of four to six S-300 batteries may have comprised one regiment. If assuming four TELs (each with four launch tubes) in each battery and four to six batteries in each regiment, one regiment in the PLA Air Force would have 16-24 TELs that could fire 64-96 missiles (with further reloads) to protect one area.

Kilo Submarines. In addition to equipping the PLA Air Force, the PRC also placed priority on acquiring modern weapon systems for the PLA Navy. By 1993,

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[59] "China Seeks S-300 and Tor-M1 Systems," *Jane's Defense Weekly*, September 2, 1998.

[60] Tai Ming Cheung, "China's Buying Spree," *Far Eastern Economic Review*, July 8, 1993; Steven J. Zaloga, "'Grumble:' Guardian of the Skies – Part 2," *Jane's Intelligence Review*, April 1997; "Russian Area Defense SAMs," *World Missiles Briefing*, Teal Group Corporation, February 2000.

[61] Office of Naval Intelligence, *Worldwide Challenges to Naval Strike Warfare*, 1997; John Pike, "S-300PMU," Nuclear Fores Guide, Federation of American Scientists ([http://www.fas.org]); Kenneth W. Allen, Glenn Krumel, Jonathan D. Pollack, *China's Air Force Enters the 21st Century*, Rand, 1995.

[62] Bill Gertz, "Chinese Bases Near Taiwan Sport Defense Missiles," *Washington Times*, March 28, 2000.

[63] "Russian Area Defense SAMs," *World Missiles Briefing*, Teal Group Corporation, February 2000.

[64] *Jane's Land-Based Air Defense 1996-97*; *Jane's Strategic Weapon Systems*, 2000.

Beijing had begun negotiations with Moscow on the purchase of perhaps four Kilo-class diesel-electric submarines (SS).[65] China finalized an agreement with Russia by November 1994 to acquire four Kilo-class submarines for about $700 million.[66] In October 1994, a PLA submarine's vulnerability to tracking by anti-submarine warfare (ASW) aircraft of the U.S. Kitty Hawk aircraft carrier battle group in the Yellow Sea may have strengthened the PLA Navy's resolve to quickly acquire advanced Russian submarines rather than waiting for new indigenous submarines.[67]

According to their reports to the U.N., China acquired a Russian warship, likely the first Kilo, in 1994, and another warship in 1995.[68] It was in February 1995 that Russia shipped the first Kilo to China aboard a cargo ship, and Russia delivered the second Kilo in October 1995.[69] The PLA's first two Kilos are the older Type 877EKM model. In 1997, China received its third Kilo, the first of two of the more advanced Type 636 model that had been supplied only to the Russian navy.[70] According to a Russian marketing brochure, the Type 636, or Project 636, submarine is one of the quietest submarines in the world. It can operate up to 400 miles submerged and remain at sea for up to 45 days.[71] With the Kilos, the PLA Navy acquired updated sonar design and quieting technology, and wake-homing and wire-guided acoustic homing torpedoes.[72] Russia transferred to the PLA its second Project 636 Kilo in late 1998.[73] While China did not report its arms transfers to the U.N. after 1997, Russian reports confirmed that it transferred a warship to China in 1997 and

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[65] Tai Ming Cheung, "China's Buying Spree," *Far Eastern Economic Review*, July 8, 1993.

[66] Robert Karniol, "China to Buy Russian 'Kilo' Submarines," *Jane's Defense Weekly*, November 19, 1994; "Russian Imports Step in to Fill the Arms Gap," *Jane's Defense Weekly*, December 10, 1997.

[67] Jim Mann and Art Pine, "Faceoff Between U.S. Ship, Chinese Sub is Revealed," *Los Angeles Times*, December 14, 1994; Barbara Starr, "'Han Incident' Proof of China's Naval Ambition," *Jane's Defense Weekly*, January 7, 1995. According to press reports, although U.S. ASW aircraft tracked the PLA submarine and the PRC scrambled fighters to within sight of the U.S. aircraft, neither side fired shots in this encounter. However, the PLA later warned a U.S. military attache in Beijing that China may use force in a future confrontation.

[68] U.N., "Register of Conventional Arms."

[69] Barbara Starr, "USA Keeps an Eye on Slow 'Kilo' to China," *Jane's Defense Weekly*, February 25, 1995; Office of Naval Intelligence, *Worldwide Maritime Challenges*, 1997.

[70] "China Should Receive Its Third 'Kilo' by November," *Jane's Defense Weekly*, July 30, 1997.

[71] Rosvoorouzhenie, "Project 636 Diesel-Electric Submarine," marketing brochure, 1996.

[72] Office of Naval Intelligence, *Worldwide Submarine Challenges*, 1997.

[73] Moscow TV Shows PRC, Iranian Crews Receiving Submarines," *NTV* (Moscow), December 30, 1998, in FBIS; "China Gets Second Sub from Russia," *Pacific Stars and Stripes*, December 31, 1998.

another in 1998.[74] China may seek two or three more Kilos, as well as upgraded weapons to arm the Kilos, including the Russian 3M54 Club anti-ship cruise missile.[75]

The Secretary of Defense has confirmed the PLA Navy's acquisition of the Kilos, saying that the Kilos, along with more ASW training, are expected to improve the capability of the PLA's submarines to conduct ASW operations. He wrote, "China's submarine fleet could constitute a substantial force capable of controlling sea lanes and mining approaches around Taiwan, as well as a growing threat to submarines in the East and South China Seas."[76]

Tor/SA-15 Air Defense Systems. In addition to the S-300 area defense system, the PLA has also acquired the shorter-range Russian Tor (SA-15) air defense system, whose missile has a range of 12 km (7 mi) against aircraft and 5 km (3 mi) against cruise missiles.[77] China initially acquired one Tor-M1 regiment by 1998 and began negotiations on an additional regiment.[78] Each regiment is believed to include 16 Tor-M1 systems, and the PLA has acquired perhaps 35 Tor-M1s. A PLA Tor-M1 regiment appears to match the Russian organization of having four batteries, each with four launch vehicles (each firing eight missiles).[79] China first ordered 13-15 systems in 1995, which were delivered in 1997, and purchased 20 more systems in 1999, with deliveries in 2000.[80] The cost of the Tor-M1 systems has been unclear, since Moscow delivered the second order in partial payment for debts to Beijing.[81] China may secure a license to produce 160 launchers.[82]

Sovremenny Destroyers and Sunburn Missiles. PRC and Russian leaders began talks on destroyers in 1994, but in late 1996, after U.S. deployment of two carrier battle groups to waters off Taiwan in March 1996 during provocative PLA military and missile exercises, Russia and China agreed on the sale of two Sovremenny-class destroyers. Each destroyer would be armed with 8 powerful (660-

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[74] U.N., "Register of Conventional Arms."

[75] Jonathan Brodie, "China Moves to Buy More Russian Aircraft, Warships, and Submarines," *Jane's Defense Weekly*, December 22, 1999; Yihong Zhang, "China Negotiates to Buy Advanced Russian Anti-ship Missile," *Jane's Defense Weekly*, August 9, 2000.

[76] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[77] *Jane's Strategic Weapon Systems*, 2000.

[78] "Russian Point Defense SAMs," World Missiles Briefing, Teal Group Corporation, February 1997; "China Seeks S-300 and Tor-M1 Systems," *Jane's Defense Weekly*, September 2, 1998.

[79] "SA-15 'Gauntlet'," *Jane's Strategic Weapon Systems*, 2000.

[80] *Military Balance 1999-2000*; Nikolai Novichkov, "Tor-M1s Help to Pay Debt to Beijing," *Jane's Defense Weekly*, March 15, 2000; Yihong Zhang, "China In Talks with Russia to Produce Tor-M1 SAM," *Jane's Defense Weekly*, July 19, 2000.

[81] *Jane's Defense Weekly*, September 2, 1998, March 15, 2000.

[82] Yihong Zhang, "China In Talks with Russia to Produce Tor-M1 SAM," *Jane's Defense Weekly*, July 19, 2000.

lb high-explosive or 200-kt nuclear warhead), over-the-horizon (range of 86 nautical miles, or 100 statute miles), supersonic (Mach 2.5), low-flying 3M-80 Moskit (SS-N-22/Sunburn) anti-ship cruise missiles (ASCMs). Each destroyer cost around $400 million, and the total package, with weapons systems, was valued at about $1 billion, marking the first Russian arms sale to China in all hard currency. In December 1996, then PRC Premier Li Peng visited Moscow and signed a military cooperation agreement that apparently included the destroyers.[83]

On December 25, 1999, the first of the two Sovremenny destroyers for the PLA Navy carried out sea trials in the Baltic Sea and was transferred to the PLA Navy at the St. Petersburg shipyard.[84] PLA and Russian naval crews then sailed the destroyer, named the Hangzhou, to China in February 2000.[85] As confirmed by the Pentagon, it joined the PLA Navy's East Sea Fleet, after sailing through the Mediterranean, Indian Ocean, South China Sea, and the Taiwan Strait.[86] By the end of 2000, Russia is expected to deliver the second destroyer, which began sea trails in June 2000 that included firings of Sunburn ASCMs.[87] In addition, China may acquire two or more Sovremenny-class destroyers.[88]

The Pentagon has confirmed that the PLA Navy has planned to receive two Sovremennys in 2000, armed with the SS-N-22 Sunburn supersonic ASCM.[89] China initially ordered about 50 Sunburn missiles, and the first shipment of 24 missiles

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[83] "Russia: Officials Sign Trade, Military, Finance Agreements," *Interfax* (Moscow), December 27, 1996, in FBIS; "China Expands Reach with Russian Destroyers," *Jane's Defense Weekly*, January 15, 1997; Bill Gertz, "Pentagon Says Russians Sell Destroyers to China," *Washington Times*, January 10, 1997; *Jane's Fighting Ships 1997-98*'; Russian Destroyers for China to Carry Moskit Missiles," *ITAR-TASS* (Moscow), November 26, 1997, in FBIS; "Russian Kamovs Set to Boost Chinese ASW," *Jane's Defense Weekly*, March 4, 1998.

[84] "Russian-Made PRC Destroyer Starts Baltic Sea Trials," *Nezavisimaya Gazeta* (Moscow), August 5, 1999, in FBIS; Trevor Hollingsbee, "Delivery of First Russian Destroyer Boosts Firepower of Navy," *South China Morning Post*, December 22, 1999; Bill Gertz, "China Will Get Russian Ship This Week," *Washington Times*, December 23, 1999.

[85] Robert Karniol, "China's First Sovremenny Sets Sail for Home," *Jane's Defense Weekly*, January 19, 2000.

[86] Craig S. Smith, "New Chinese Guided-Missile Ship Heightens Tension," *New York Times*, February 9, 2000; Pentagon, news briefing, February 10, 2000; "China's Destroyer Purchase from Russia Discussed," *Zhongguo Tongxun She* [China News Agency] (Hong Kong), February 12, 2000, in FBIS.

[87] Bill Gertz, "Russia Readies Warship for China," *Washington Times*, July 12, 2000; Nikolai Novichkov, "Second Chinese Destroyer Tested," *Jane's Defense Weekly*, July 26, 2000.

[88] Jonathan Brodie, "China Moves to Buy More Russian Aircraft, Warships, and Submarines," *Jane's Defense Weekly*, December 22, 1999; Nikolai Novichkov, "Four Sovremennys in Total for Beijing," *Jane's Defense Weekly*, March 15, 2000; "Russia-China Destroyer Deal Detailed," *Nezavisimaya Gazeta* (Moscow), March 15, 2000.

[89] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

arrived in China in the spring of 2000.[90] In addition, the PLA has also acquired Uragan (SA-N-7 Gadfly) surface-to-air (SAM) missiles and eight Ka-27 and Ka-28 ASW helicopters.[91] In 2000, the Secretary of Defense's report to Congress confirmed that the PLA is acquiring the SA-N-7 SAM system equipped on the Sovremennys and wrote that the SA-N-7 "is a modern, medium-range naval SAM system; however, it will have only a limited capability against cruise missiles."[92]

A-50 Airborne Early Warning. To more effectively utilize its advanced fighters, the PLA Air Force and PLA Navy have long required airborne early warning (AEW) aircraft, with each service originally seeking perhaps ten AEW systems from European, Russian, or Israeli sources, to supplement unsuccessful PRC developmental efforts.[93] The PLA would acquire potential new capabilities, ranging from AEW aircraft (largely radars in the sky) to airborne early warning and control systems (AWACS) aircraft (an airborne command post that detects enemy targets and provides battle management by coordinating attacks among air, naval, and ground forces). The roles of these aircraft could be defensive (detecting aircraft and cruise missiles) or offensive (command of fighters). Moreover, the implications of the PLA's AEW acquisitions would also depend on how well they are used in conjunction with other ongoing acquisitions, such as fighters and naval vessels.

By 1992, China had begun talks with Russia about purchasing perhaps three modified Il-76 AEW aircraft.[94] Later, talks involved acquisition of an Israeli radar system. Three-way negotiations that began in 1994 considered four AEW aircraft for $1 billion. However, China, Russia, and Israel reached initial agreement in 1996 on a $250 million deal to supply one AEW aircraft to the PLA Air Force by installing an Israeli Aircraft Industries (IAI) Phalcon phased-array radar with 360 degree coverage on a modified Russian Il-76 plane.[95] The Phalcon system could be similar in capability to U.S. E-3 AWACS on Boeing 707s. One source said that the Phalcon could track up to 60 targets at the same time and guide a dozen fighters in all-weather, day and

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[90] "Russia to Export More 'Sunburn' Anti-Ship Missiles to PRC," *ITAR-TASS* (Moscow), September 25, 1998, in FBIS; Simon Saradzhyan, "Russians Tout Anti-ship Sunburn Missile for Chinese," *Defense News*, October 12-18, 1998; Bill Gertz, "Russia Sends Cruise Missiles to China for New Warships," *Washington Times*, May 19, 2000.

[91] "Russia Delivers Eight Anti-Sub Helicopters to China," *ITAR-TASS* (Moscow), December 10, 1999, in FBIS; "China Receives Russian Equipment," *Jane's Defense Weekly*, January 5, 2000.

[92] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[93] G. Jacobs, "China's Changing Doctrine," *Jane's Defense Weekly*, March 10, 1990; "West Briefs China on AEW," *Flight International*, August 25-31, 1993; Robert Karniol, "China Chose 'Careless' Platforms," *Jane's Defense Weekly*, May 6, 1995; Jason Glashow and Vivek Raghuvanshi, "China Seeks AEW To Guard Su-27s," *Defense News*, March 18-24, 1996.

[94] Tai Ming Cheung, "Loaded Weapons," *Far Eastern Economic Review*, September 3, 1992.

[95] Ari Egozi, "Israel Presses Russia in Bid to Clear Way for China AEW Deal," *Flight International*, July 17-23, 1996.

night operations,[96] while another report credited the Phalcon as being able to track 100 targets simultaneously.[97] Meanwhile, China also looked to Britain's GEC-Marconi Avionics to equip up to four Il-76s with an AEW system, and Russia wanted to supply its own AEW system.[98]

The Phalcon deal became an increasingly controversial issue between the United States and Israel. After military tensions in the Taiwan Strait that included PLA "test-firings" of M-9 short-range ballistic missiles (in 1995 and 1996) and U.S. deployment of two aircraft carrier battle groups (in March 1996), U.S. officials, including Defense Secretary William Perry, expressed concerns to Israeli officials about the pending AEW sale.[99] In May 1997, Israel and Russia reached agreement on modifying one Il-76, as a Beriev A-50I Mainstay, for $250 million, with the option of three more AEW systems for a total cost of $1 billion.[100] Russia secured about 20 percent of the deal.[101]

After some delay, in October 1999, Russia transferred an Il-76 transport plane to Israel for the installation of the Phalcon AEW radar by IAI. Pentagon spokesperson Ken Bacon confirmed the arrival of the IL-76 in Israel and stated that Defense Secretary William Cohen "has repeatedly raised his concerns with Israel about the transfer of technology to China."[102]

The Clinton Administration voiced stronger objections to the sale and urged Israel to cancel the sale of the Phalcon, saying it is a system comparable to the U.S. AWACS and could collect intelligence and guide aircraft from 250 miles away.[103] President Clinton confirmed that the United States raised the issue with Israel. While acknowledging that "the facts are in dispute," Clinton said that "whenever any of our

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[96] O'Sullivan, Arieh, "Israel Mum on China Defense Ties," *Jerusalem Post*, November 17, 1999.

[97] Chaisson, Kernan, "Airborne Surveillance Takes Command," *Journal of Electronic Defense*, January 1999.

[98] "China Poised to Seal AWACS Deal with British Firm," *AFP*, October 8, 1996, in FBIS.

[99] "U.S. 'Concern' Sparks 'More Circumspect' Approach to PRC," *Jerusalem Post*, October 31, 1996, in FBIS; Steve Rodan, "Israel Pushes China Aircraft Deal Despite U.S., Russian Objections," *Defense News*, January 6-12, 1997.

[100] "Russia Agrees Il-76 Sale to IAI for AEW," *Flight International*, March 19-25, 1997; Douglas Barrie and Ari Egozi, "Il-76 Deal Raises Israeli Hopes in Bid for China AEW Contract," *Flight International*, May 21-27, 1997; Steve Rodan, "Israel, Russia to Team on Early Warning Platform for China," *Defense News*, May 19-25, 1997; "Russia, Israel to Make Spy Planes," *Wall Street Journal*, June 23, 1997.

[101] Steve Rodan, "Il-76 AEW Upgrade Bolsters Israeli, Russian Industry Ties," *Defense News*, July 21-27, 1997.

[102] "Israel to Convert Russian Spy Plane for China," *Ha'aretz* (Tel Aviv), November 2, 1999, in FBIS; Barbara Slavin, "Israel-China AWACS Deal Worries U.S.," *USA Today*, November 4, 1999.

[103] Steven Lee Myers, "U.S. Seeks to Curb Israeli Arms Sales to China," *New York Times*, November 11, 1999.

friends sell sophisticated equipment that might be American in origin that is inconsistent with the terms under which the transfer was made, then we raise that."[104]

Nonetheless, U.S. objections have been based not only on the question of whether Israel would transfer U.S. technology to China, but also based on concerns about Israeli upgrades to PLA capabilities that would affect the security situation in Asia. Dov Zakheim, a former Deputy Undersecretary of Defense, wrote that "what matters is that Israel should not be in the business of complicating America's already delicate position vis-a-vis China and Taiwan, one that led to a major crisis in the Taiwan Strait only three years ago. Nor should Israel help to unbalance the equally delicate relationship between China and America's major regional allies, notably Japan and the Republic of Korea."[105] By late 1999, some Members of Congress also objected to the sale, including Senator Helms, who wrote to the Israeli Ambassador in Washington that U.S. security "will be put at risk by the Phalcon and other Israeli sales to Beijing."[106]

According to the Pentagon, the United States has expressed opposition to the sale since 1996,[107] but in 2000, U.S. opposition to Israel's transfer of the Phalcon AEW/AWACS system to China mounted openly. Speaking in Jerusalem at a news conference with Israeli Prime Minister Ehud Barak on April 3rd, Defense Secretary Cohen called on Israel to cancel the "counter-productive" sale. Cohen said, "I have indicated before that the United States does not support the sale of this type of technology to China because of the potential of changing the balance in that region, with the tensions running high as they are between China and Taiwan."[108]

There was also bipartisan opposition in Congress. On April 6, 2000, Representative Sonny Callahan, chairman of the House Appropriations Subcommittee on Foreign Operations, Export Financing, and Related Programs, sought to withhold $250 million, equivalent to the value of the Phalcon sale, from the almost $3 billion in economic and military aid, if Israel transfers the plane to China. Representative David Obey, the ranking Democrat on the Appropriations Committee supported the effort.[109]

By May 2000, Israel had nearly completed work on the AEW aircraft.[110] Finally, on July 11, 2000, during peace talks at Camp David, MD, Prime Minister Barak told President Clinton that Israel had canceled the Phalcon sale in a letter delivered to PRC

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[104] White House, "Remarks by the President on Education and the Budget," November 11, 1999.

[105] Dov S. Zakheim, "Get Real on China," *Jerusalem Post*, November 22, 1999.

[106] Senator Jesse Helms, letter to Zalman Shoval, Embassy of Israel, November 17, 1999.

[107] Pentagon, news briefing, April 11, 2000.

[108] Pentagon, news briefing with Secretary of Defense William S. Cohen, April 3, 2000.

[109] Eric Pianin, "Israel-China Radar Deal Opposed," *Washington Post*, April 7, 2000.

[110] Bill Gertz, "Inside the Ring," *Washington Times*, May 19, 2000.

President Jiang Zemin the day before.[111] Many expect Russia to complete the sale of AEW aircraft to China, with existing A-50s from the Russian Air Force and/or, later, an advanced A-50E version (possibly costing $180-200 million each), that would bring Russia more earnings than the original deal involving Israel. The A-50E is designed to guide up to 30 aircraft and track 300 targets as far as 250 miles away.[112]

The Pentagon's 1999 report to Congress on Taiwan security expected that the PLA would procure "several" Phalcon AEW systems and noted that the PRC "conceivably could have fully operational AEW platforms by 2005."[113] The 2000 report, however, noted that the PLA Air Force's AEW program remains behind schedule. The report noted the expectation that the PLA Air Force would achieve the incorporation of both aerial refueling and AEW/airborne command and control capabilities later in the decade. Such capabilities would provide a significant "force multiplier," but only for a relatively small number of aircraft at one time.[114]

At about the same time that the PLA Air Force looked at procuring the A-50 AEW aircraft in 1996, China reportedly signed a contract with a British firm, Racal Thorn Defense of Racal Electronics, to buy six to eight Searchwater maritime reconnaissance radars to equip Y-8 aircraft of the PLA Navy, in a deal valued at about $62 million.[115] However, it appears that both sides did not conclude the sale, and there are no reports that the PLA Navy has deployed the new system. Indeed, the Pentagon's report to Congress on China's military power, submitted in June 2000, did not mention such acquisitions by the PLA Navy.[116]

Su-30 Fighters and Armaments. By 1996, China and Russia had begun negotiations over the Su-30 long-range fighter.[117] By August 1999, China and Russia

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[111] Pauline Jelinek, "Israel Cancels Arms Sales to China in Midst of U.S. Summit," *Associated Press*, July 12, 2000; Jane Perlez, "Israel Drops Plan to Sell Air Radar to China Military," *New York Times*, July 13, 2000.

[112] Ivan Safronov, "Israel Will Help Us," *Kommersant* (Moscow), July 14, 2000, in FBIS; Simon Saradzhyan, "China to Explore Buy of Russian Early Warning Aircraft," *Defense News*, July 31, 2000.

[113] Secretary of Defense, "The Security Situation in the Taiwan Strait," Report to Congress Pursuant to the FY99 Appropriations Bill, February 1999.

[114] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[115] Barbara Opall and Michael J. Witt, "China Pits U.K. vs. Israel in AEW Quest," *Defense News*, August 5-11, 1996.

[116] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[117] "China Expands Reach with Russian Destroyers," *Jane's Defense Weekly*, January 15, 1997; Nikolai Novichkov, "Russia and China Tighten Links on Military Projects," *Jane's Defense Weekly*, August 19, 1998; John Pomfret, "China, Russia Forging Partnership," *Washington Post*, November 21, 1998; Christiaan Virant, "China, Russia Hammer Out Arms

(continued...)

signed a preliminary agreement (letter of intent) on the transfer of new Su-30MKK fighters for the PLA Air Force, an initial deal that may include around 40 fighters valued at about $2 billion.[118] There also are indications that China may later seek an additional 40 Su-30s.[119] China reportedly has sought an aerial refueling capability with the Su-30MKK, but its converted H-6 tankers cannot be used for the Russian fighters.[120] Delivery of the Su-30s to the PLA Air Force is not yet reported and may begin in 2002, 2003, or even 2004.

It remains unclear which armaments China will acquire for the Su-30 fighter. The PRC and Israel have negotiated, since at least 1997, on the transfer of Python-4 beyond-visual-range AAMs.[121] China and Russia have co-developed the KR-1 anti-radiation missile, a variant of the Kh-31P (AS-17 Krypton) that has been added to a version of the Su-30.[122] The talks in 1998 included whether the Su-30 would be armed with the newly-developed 3M-80EA anti-ship missile, the air-launched version of the Moskit (SS-N-22 Sunburn) equipped on the Sovremenny destroyers, although the missile had not yet undergone flight tests.[123] There have been increasing indications that the Su-30 fighter sold to the PLA Air Force may be equipped with the R-77 (AA-12), a medium-range AAM (similar to the U.S. AIM-120 Advanced Medium-Range Air-to-Air- Missile, or AMRAAM) or a version of which Russia may sell to or co-produce with China.[124]

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[117] (...continued)
Deals," *Reuters*, October 22, 1998; *Jane's All the World's Aircraft 2000-2001*.

[118] Barbara Opall-Rome, "China Sets Sights on 50 Su-30s," *Defense News*, July 5, 1999; "Russia, China Conclude Deal to Produce Fighter Jets," *Interfax* (Moscow), August 6, 1999, in FBIS; Robert Sae-Liu, "Su-30MK Purchase on Chinese Agenda," *Jane's Defense Weekly*, August 11, 1999; Philip Finnegan and Simon Saradzhyan, "New Capabilities Heighten Asian Tensions," *Defense News*, August 23, 1999; "Klebanov: Russia to Sell Su-30s to China," *ITAR-TASS* (Moscow), August 24, 1999, in FBIS; Piotr Butowski, "Dominance by Design: the Reign of Russia's 'Flankers'," *Jane's Intelligence Review*, November 1999; "Overview of Russia-PRC Military-Technical Cooperation," *ITAR-TASS* (Moscow), January 16, 2000, in FBIS.

[119] Jonathan Brodie, "China Moves to Buy More Russian Aircraft, Warships, and Submarines," *Jane's Defense Weekly*, December 22, 1999.

[120] Robert Sae-Liu, "Refueling Go-Ahead by China," *Jane's Defense Weekly*, August 25, 1999.

[121] Douglas Barrie, "Russia and Israel Prepare for Dogfight Over Chinese Missile," *Flight International*, September 24-30, 1997; Paul Lewis, "Israel/Russia Compete to Arm F-10 Fighter," *Flight International*, October 15-21, 1997; "U.S. To Question Israel on China Tech Transfers," *Defense News*, December 8-14, 1997.

[122] Douglas Barrie, "China and Russia Combine on KR-1," *Flight International*, December 10-16, 1997; Barbara Opall-Rome, "China Sets Sights on 50 Su-30s," *Defense News*, July 5, 1999; *Jane's All the World's Aircraft 2000-2001*.

[123] Simon Saradzhyan, "Russians Tout Antiship Sunburn Missile for Chinese," *Defense News*, October 12-18, 1998.

[124] Paul Lewis, "Russia Reviews Chinese Sales," *Flight International*, September 17-23, (continued...)

The above discussion of PRC efforts to acquire foreign advanced conventional weapons raises questions regarding the effect of those systems on PLA capabilities and implications for regional security. The following two sections will assess the PLA's air power and naval capabilities in light of the acquisitions.

Assessment of Air Power Acquisitions[125]

Platform Comparisons

The following section compares the capabilities of the fighter aircraft, AAMs, and SAMs that China has imported to those produced indigenously by China as well as to those found in some other Asian militaries and U.S. forces based in the region. This comparison does not provide a complete picture of PLA air power capabilities. It is, however, a necessary first step for further assessment. A platform-to-platform comparison of these systems indicates that China's imported systems appear to be notably more capable than indigenous systems and are roughly on-par with Western aircraft, AAMs, and SAMs.

Fighter/Attack Aircraft. Indigenous PLA fighter and attack aircraft have been described by various analysts as obsolete and antiquated. There is consensus in U.S. defense circles that the PLA Air Force is beset with many weaknesses. The foremost weakness "...is that the PLAAF is currently saddled with over 2,000 aircraft of 1950s-era Soviet design comparable to outdated U.S. fighters like the F-100, F-8, and B-47."[126]

The Su-27 (and Su-30, once delivered later) represent a significant upgrade in fighter aircraft capability over indigenous PLA aircraft. Making simple performance comparisons, it is clear that the Russian fighters fly farther and faster than indigenous PRC fighters. The Su-27 and Su-30 are more maneuverable, and carry more and better armament than domestic PRC aircraft. According to some analysts, the Su-27and Su-30 that China has sought to acquire from Russia are roughly comparable

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[124] (...continued)
1997; Paul Lewis, "Israel/Russia Compete to Arm F-10 Fighter," *Flight International*, October 15-21, 1997; Tim Butcher, "Russia and China 'are Developing Super-Fast Missile'," *London Daily Telegraph*, January 3, 2000; Steven Mufson and Thomas E. Ricks, "Pentagon Won't Back Taiwan Deal," *Washington Post*, April 17, 2000; *Jane's All the World's Aircraft 2000-2001*; Duncan Lennox, "China, India Close in On Russian 'Adder' Sale," *Jane's Defense Weekly*, September 6, 2000. In April 2000, the Pentagon decided to support a sale of AMRAAMs to Taiwan, with the missiles to be kept in the United States where Taiwan personnel would be trained to use them. The missiles would be transferred to Taiwan, if the PLA acquired the similar Russian missile. On September 28, 2000, the Pentagon announced that it approved the sale of 200 AIM-120C AMRAAMs to Taiwan.

[125] Prepared by Christopher Bolkcom, Analyst in National Defense.

[126] Tirpak, John, "Can the Fighter Force Hold Its Edge?" *Air Force Magazine*, January 2000: 27. and Fisher, Richard D., "China's Purchase of Russian Fighters: A Challenge to the U.S.," *Asian Studies Center Backgrounder*, The Heritage Foundation, July 31, 1996.

to the U.S. F-15C air superiority fighter.[127] Indeed, the information in Table 4 below suggests that the Su-27 is in many ways comparable to the best fighters in other Asian and U.S. inventories. The Su-27's flight profile and armament are similar to those of the F-14, F-15, F-16, F/A-18C/D, Indigenous Defense Fighter (IDF) (of Taiwan), and Mirage 2000. The Su-27 may be more maneuverable than the best Western fighters. The Russian fighter has been described by observers as having "unbelievable agility" and being able to perform maneuvers that "no Western fighter can emulate."[128]

There are, however, additional fighter/attack aircraft characteristics that are important measures of performance. These factors – including radar cross section and electronic countermeasures, for instance – are difficult to quantify or compare in the unclassified milieu. A comparison of these factors would provide a clearer picture of how the Su-27 measures up to the Western fighter aircraft.

Radar Cross Section. An aircraft's radar cross section has a significant effect on its survivability. Aircraft that incorporate stealth materials and design techniques to reduce their radar cross sections are more difficult to detect, track, and engage than aircraft that have larger radar cross sections. The general design of indigenous PRC aircraft and their lack of composite materials strongly suggest they have large radar cross sections. By comparison, the Russian fighters use modern designs that, while not stealthy on the scale of aircraft designed specifically to be stealthy, reduce their radar cross sections appreciably relative to indigenous PRC fighters. A U.S. Air Force assessment asserts that the Su-27's radar cross section is "on par" with the F-15C's, but it does not provide data to substantiate this assessment.[129] Lacking the supporting data on radar cross section, it is impossible to make definitive statements regarding how stealthy the Su-27 is relative to Western fighter aircraft. However, some observations can be made that suggest that the U.S. fighter aircraft based in Asia may have lower radar cross sections than the Su-27.

First, it can be observed that while Russia does possess the ability to incorporate stealth materials and designs in its military aircraft, it has not yet advanced to the level of the United States in this technology. Furthermore, the United States continues to refine its stealth technologies by developing a third generation of stealthy aircraft: the F-22 Raptor. As the U.S. defense establishment improves its knowledge of stealth while working on programs like the F-22 and Joint Strike Fighter, it identifies radar deflecting or absorbing techniques that can be employed on existing aircraft.[130]

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[127] Fisher, Richard D., "China's Purchase of Russian Fighters: A Challenge to the U.S.," *Asian Studies Center Backgrounder*, The Heritage Foundation, July 31, 1996.

[128] Lake, Jon, "Sukhoi Su-27 Flanker," *World Air Power Journal*, Aerospace Publishing Ltd. London. 1994: 6.

[129] Tirpak, John, "Can the Fighter Force Hold its Edge?" *Air Force Magazine*, January 2000.

[130] In the B-2 program, gold paint was found to significantly reduce the radar reflection from cockpit canopies and was subsequently applied to F-16 and helicopter canopies in the US inventory. Browne, Malcolm, "Will the Stealth Bomber Work?" *New York Times*, July 17, 1988; Cook, Nick, "The Disappearing Helicopter," *Jane's Defense Weekly*, July 28, 1999.

Table 4. Comparison of Fighter/Attack Aircraft

	PRC Aircraft				Russian Aircraft		Other Asian and U.S. Aircraft in Asia					
	J-6	**J-7**	**J-8**	**Q-5**	**SU-27**	**Su-30**	**F-14**	**F-15C**	**F-16D**	**F/A-18C/D**	**IDF**	**Mirage 2000**
IOC	1953	1966	1969	1965	1982	1988	1989	1979	1981	1986	1994	1991
Max Speed (nm/hour)	783	648	701	643	1,350	1,350	1,210	1,610	>1,290	>1,160	1,160	1,420
Max Range w/tanks (nm)	1,187	1,203	1,188	982	1,985	2,800 (w/refuel)	1735	2,200	1,740	1,333	1,200	1,800
+G limit (M.09)	N/A	7	4.8	7.5	9	9	-	9	9	7.5	9	9
Missiles & Bombs	4 AAM 2 500 lb bombs	36 Air-air rockets 2 300 lb bombs	PL-7 AAMs unguided AA rocket bombs	5 500 lb bombs 4-7 AS rocket	10 AAM in AA role unguided bombs	10 AAM in AA role unguided bombs	6 AIM-54, AGM-84/88	8 AIM-120 3 AGM hard point	6 AAM or 7 AGM-65	6 AIM-120, 4 AGM-65	6 hard point	9 hard point

Sources for all tables in this assessment: *Jane's All the World's Aircraft, Jane's Aircraft Upgrades, Jane's Land-Based Air Defense, Jane's Strategic Weapon Systems, Jane's Air Launched Weapons, World Military & Civil Aircraft Briefing* (Teal Group Inc), *World Missile's Briefing* (Teal Group Inc), *Aerospace Source Book 2000 (Aviation Week & Space Technology), The World's Missile Systems* (General Dynamics, Inc.), and conversations with U.S. Army, U.S. Navy, and U.S. Air Force Offices of Legislative Affairs. Unclassified information on the capabilities of Russian and PRC weapon systems is often inconsistent and contradictory. When information was found to be contradictory, the most conservative estimate was recorded in these tables.

Another observation that suggests that the Su-27 radar cross section may be inferior to that of U.S. aircraft is that the Su-27s operated by China are export aircraft. It is usually (but not always) the case that an export variant of a given aircraft does not incorporate the latest and most potent components. Thus, it would be a very common practice for Russia to eliminate radar reducing elements of the Su-27 exported to China, if feasible. Furthermore, materials and technologies that improve an aircraft's stealthiness are often costly and difficult to maintain. In light of China's maintenance shortcomings that will be outlined below, the PLAAF may have difficulty maintaining any stealth capabilities that its Su-27s may possess.

Electronic Countermeasures. The effectiveness of an aircraft's electronic countermeasures (ECM) is a strong determinant of its survivability. In an era of sophisticated radar and infrared (IR) guided surface-to-air and air-to-air missiles, and radar guided anti-aircraft artillery, modern fighter aircraft rely on a variety of countermeasures to survive in hostile airspace. These systems include radar warning receivers, self-protection jamming pods, towed radar and IR decoys, chaff dispensers, and flare dispensers.

Information on the range, power, frequency, and other characteristics of electronic warfare (EW) systems and ECM are as jealously guarded as is information on stealth capabilities. Unclassified information on Russian aircraft EW and ECM typically include nothing more informative than a NATO-generated code name, the suspected manufacturer, the approximate physical dimensions of the device, and the aircraft on which it has been observed. Another factor complicating the comparison of Russian aircraft EW/ECM and Western aircraft EW/ECM is that these devices are very portable. They are often based in under-wing pods and can be installed or removed from an aircraft with relative ease.

It appears that Russia's EW and ECM capabilities are roughly comparable to the United States'. During the 1999 war in Kosovo (Operation Allied Force), for instance, NATO military planners expressed strong concern over Serbia's EW/ECM capabilities – largely based on imported Russian equipment – even though "the alliance didn't face the most sophisticated Russian electronic warfare equipment available."[131] China's ability to optimally operate and maintain the EW/ECM systems that are found on their Su-27s is another factor that is important, but difficult to assess reliably.

Air-to-Air Missiles. PRC-manufactured AAMs are analogous in capability to the indigenous fighters on which they are employed. They are, or are based on, first generation weapon systems that trace their lineage to 1960s era designs. The PL-2, -5, -7, -8, and -9 are short-range AAMs (3-5 km; 2-3 mi) and depend on IR guidance. The oldest systems (PL-2, -4, -7) can only engage targets from the rear, which limits their flexibility and constrains the aircraft's pilot.

China's imported AA-10 and AA-11 represent as great an improvement over indigenous AAMs as do the Russian fighters over indigenous PRC fighters. These

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[131] Asker, James, "NATO Insecurities," *Aviation Week & Space Technology,* July 26, 1999:27.

missiles are effective to much longer ranges than the PRC AAMs, which adds to their operational effectiveness and increases launch-aircraft survivability. The Russian AAMs – especially the AA-11 – are highly maneuverable missiles, a feature that increases their lethality.

Although the PLA Air Force has not yet acquired the Russian AA-12 or Israeli Python 4 AAMs, it has reportedly sought them. If successfully acquired, these systems will also represent a significant improvement in the PLA's AAM capability. The AA-12 has been called the "AMRAAMski," indicating its similarities to the premier U.S. medium-range (75 km; 47 mi) air-to-air missile. The Python 4's range of 15 km (9 mi) is more in keeping with the range of PRC missiles. However, this missile is extremely maneuverable, and it incorporates advanced seeker technology that increases the missile's lethality and increases launch-aircraft survivability.

Table 5 provides information that can be used to compare domestic PRC AAMs to imported Russian AAMs as well as other Asian and U.S. AAMs. Russian AAMs have been described generally as being of "high technical quality."[132] One analyst has described the AA-10, for instance, as "generally comparable to the American AIM-7M Sparrow missile..."[133]

Similar to the case of assessing fighter aircraft, air-to-air missiles possess additional characteristics that bear strongly on their effectiveness. These characteristics – including seeker discrimination capability and susceptibility to electronic countermeasures, for instance – are very difficult to assess due to classification and complexity. Even experts in the U.S. missile industry write that "Evaluation of missile intercept performance involves so many nonlinear functions that only sophisticated analytical modeling can reliably predict results."[134]

Nonetheless, some observations can be made regarding two additional characteristics that shed light on the utility of the AA-10 and AA-11 acquired by the PLA Air Force *vis-a-vis* Western AAMs. These characteristics are "fire-and-forget" capability and the missile's "off-boresight" launch envelope. These two characteristics are central to air superiority operations, because they often determine which aircraft achieves the first shot during aerial combat.

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[132] Zaloga, Steven, "Russian Air-to-Air Missiles," *World Missiles Briefing*, Teal Group Inc., February 2000.

[133] FAS, [http://www.fas.org/man/dod-101/sys/missile/row/aa-10.htm].

[134] Gurvine, Jeff, and Edwin Stauss. *Fundamentals of Tactical Missiles*. Raytheon Missile Systems Company. Tucson, AZ. 1997: 8-39.

Table 5. Comparison of Air-to-Air Missiles

	PRC Missiles					Russian Missiles		Other Asian and U.S. Missiles					
	PL-2B	**PL-5**	**PL-7**	**PL-8**	**PL-9**	**AA-10**	**AA-11**	**AIM-7**	**AIM-9M**	**AIM-54C**	**AIM-120**	**Mica**	**Sky Sword**
IOC	1981	1982	1987	1990	1991	1985	1987	1988	1982	1985	1991	1996	1993
Range km	3	3	3	5	5	80-110	20-30	45	8	150	50	80	5
Warhead kg	11	9	13	11	10	44	7.4	39	10	60	22	12	~10
Guidance	IR	IR	IR	IR	IR	INS, IR, SAR	INS, IR	SAR	IR	SAR, Inertial and active radar	Com-mand inertial, active radar	Com-mand inertial active or imagin g IR	IR
Misc	Tail aspect attacks only no off bore-sight	> off bore-sight than PL-2/3	10 ft lethal radius. tail-aspect attacks only	Based on Python 3	High Alti-tude (69k ft)	8 G intercept	12 G intercept Helmet mounted cueing	All Wx All aspect	Helmet mounted sight	Home on jam	All Wx, All aspect, fire and forget	Thrust - AIM-120 like	All aspect, AIM-9 like

"Fire-and-Forget" Capability. Shorter-range AAMs can effectively use IR guidance. Once an IR missile is launched, the host aircraft's role in missile guidance is complete, and the aircraft can prepare another missile for launch, initiate evasive action, or target another hostile aircraft. In essence, the aircraft can fire and forget the missile. However, as range increases, the effectiveness of IR-guided missiles diminishes.

Radar guided missiles operate more effectively at longer ranges than do IR missiles. Active radar missiles use a radar transmitter to autonomously track targets at short- and medium-ranges. Semi-active radar missiles require the host aircraft's radar to illuminate the target until missile impact. Generally speaking, AAMs that employ active radar guidance, such as the AIM-54C, AIM-120, and Mica, fly more independently after launch than do AAMs that employ semi-active radar guidance, such as the AA-10 and AIM-7R. Thus, the AA-10 is not a fire-and-forget missile and thus not as attractive from an aircraft survivability perspective as, say, an AIM-120. However, the AA-10 "has a lock-on range of 30 km [20 mi] against typical fighter aircraft targets...,"[135] which may make up partially for this disadvantage.

"Off-Boresight" Capability. Traditionally, AAMs are launched by pointing the host aircraft directly at the hostile aircraft and using a sight to line up the target. The requirement to fire from this position gives advantage to the most maneuverable aircraft or the pilot with the greatest tactical flying skill. The ability to fire a missile from "off boresight" also proves advantageous, either by contributing by extension to an aircraft's maneuverability or by countering an adversary's maneuverability.

The AA-11's most distinguishing characteristic is its high maneuverability and its off-boresight capability. The AA-11 is the first effective "helmet-sighted" air-to-air missile. With this system, a pilot can aim his weapon by turning his head and does not have to line up the aircraft with the target. The first generation of AA-11s can be fired 45 degrees off the aircraft's forward line-of-direction, or off-boresight. The second generation of this AAM has increased range and can be fired 60 degrees off-boresight. The AIM-9M Sidewinder, by comparison, can acquire targets only 27.5 degrees off the forward line of sight and has a shorter range.[136] Some analysts assert that the AIM-120's long range and fire-and-forget capability confer much of the same tactical flexibility as the AA-11."[137]

The combination of the PLA's AA-11 AAM and highly maneuverable aircraft imported from Russian could prove a vexing air-to-air challenge to current day fighter aircraft of other Asian and U.S. forces. The Russian MiG-29 has been flown against U.S. aircraft in Red Flag exercises at Nellis Air Force Base, Nevada. At longer distances, the U.S. aircraft were found to have the advantage versus the Russian plane due to superior avionics. As the distance between aircraft closed, however, the MiG's

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[135] *Jane's Air-Launched Weapons*, Jane's Information Group Ltd., 1997, London.

[136] The next generation of the AIM-9, to be deployed in 2003, is expected to achieve 90 degree off-boresight launches.

[137] Fisher, Richard D, "China's Purchase of Russian Fighters: A Challenge to the U.S.," *Asian Studies Center Backgrounder*, The Heritage Foundation, July 31, 1996.

high maneuverability and the AA-11's off-boresight capabilities defrayed the U.S. aircraft's advantage. Observers noted that, at a distance of approximately five miles, the Russian aircraft enjoyed a significant advantage.[138] The Su-27 is also a highly maneuverable aircraft, and the combination of it and the AA-11 will likely prove as dangerous a combination as the MiG-29 and AA-11.

Surface-to-Air Missiles. China manufactures five different SAM systems. Two of them – the HN-5 and QW-1– are short-range, man-portable systems. Based on the 1960s era Russian SA-7, the HN-5's utility is limited by a primitive IR seeker that often cannot differentiate between an aircraft's engine signature, the sun, or heat radiating off the ground. While the QW-1 IR seeker is much improved over the HN-5's, this missile's engagement envelope is even more limited than its predecessor's.

China's HQ-2 SAM is effective to a much greater altitude and range than the manportable SAMs, but it is based on Russia's first generation, 1950s era SA-2 SAM, and is the oldest technology in China's inventory. The HQ-2 employs a liquid fueled second stage rocket motor, which requires time-consuming preparation and cumbersome handling equipment. This SAM has been described by at least one analyst as "antiquated."[139] By reverse engineering foreign SAMs, China was able to incorporate some improvements in the PL-9 and HQ-7 SAMs not found in earlier PRC systems. These improvements include better seekers that allow off-axis launch and reportedly electronic countermeasures such as "home on jam." However, these systems and the less advanced HQ-61 are still short-range SAMs designed to defend against low-to-medium altitude aircraft.

The Russian SAMs acquired by China – the SA-15 and especially the SA-10 – represent marked improvements in China's ability to target aircraft that threaten its airspace. The SA-15's range and intercept altitude are similar to China's most modern indigenous SAMs. However, the SA-15 features a number of characteristics that make it a more effective system. For instance, the SA-15 can use its surveillance and tracking radars and can fire missiles while moving. It can fire two missiles simultaneously at two different targets. Perhaps more significantly, this system can engage cruise missiles and unmanned aerial vehicles (UAVs). It has also been reported that the SA-15 may have some capability against short-range ballistic missiles.[140] None of these features is found on indigenous PRC SAMs.

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[138] "German MiG-29s in Red Flag Exercise," *Aviation Daily*, August 1, 2000.

[139] Zaloga, Steven. *World Missiles Briefing*, Teal Group Inc., Fairfax, VA, November 1999.

[140] *Jane's Land-Based Air Defense 1997-1998*; *World Missiles Briefing*, Teal Group, February 2000; "China Seeks S-300 and Tor-M1 Systems," *Jane's Defense Weekly*, September 2, 1998.

Table 6. Comparison of Surface-to-Air Missiles

	Indigenous PRC Missiles						Imported Russian Missiles		Other Asian and U.S. SAMs				
	HQ-2	**HN-5**	**QW-1**	**HQ-61**	**HQ-7**	**PL-9**	**SA-10 S-300 PMU**	**SA-15**	**Patriot PAC 2**	**PAC3**	**Hawk**	**I-Hawk**	**Sky Bow 2**
IOC	1967	1966	1994	1991	1991	1991	1992	1988	1991	2001	1960	1973	1995
Max Range (km)	35	3.6	0.5	10	12	5.5	90	12	>105	15[a]	40	40	80
Max Altitude (km)	27	2	0.4	8	5.5	5	30	6	25	>15	18	18	24
Surveill. Radar Range (km)	120	-	-	-	20	>15	300	>25	170	N/A	560	560	150
Warhead (kg)	130	1.1	1.5	42kg?	14	10	143	15	84	142	75	75	90
TBM Capable	No	No	No	No	No	No	Yes	Some	Yes	Yes	No	Yes	No
Misc	Based on SA-2?	Copy of SA-7	HN-5 up-grade	CSA-N-2 marin-ized version	Crotale copy?	Python 3 copy?		12 G intercepts. Fire on the move	13 G inter-cept	ATBM opt-imized	All Wx, Day/ Night	Im-proved guid-ance, ECM	Based on Patriot

[a] The Patriot PAC-3 has a range of 15 km against tactical ballistic missiles.

The SA-10 SAM system is considered similar to the U.S. Patriot system. It is most distinguished by its very long range and very high intercept altitude. With a range of up to 150 km (93 mi), a handful of SA-10s potentially could cover large volumes of PRC airspace; protecting cities, airfields, and potential attack corridors. The SA-10's very long range surveillance radar is also a significant improvement over indigenous PRC systems. With its ability to detect aircraft up to 300 km (186 mi) away, the SA-10s could provide China with earlier warning of attacking aircraft and more effective, integrated air defenses. Additionally, the SA-10 has the ability to attack cruise missiles and perhaps limited defense against some ballistic missiles.

Table 6 contains information that can be used to compare China's most advanced imported surface-to-air missiles to those used by other Asian and U.S. forces. This information suggests that the SA-10 and SA-15 are in many ways on par with U.S. and similar SAMs in the region. However, the most useful level of comparison for these systems is not between the PLA's SAMs and those other SAMs, but between the PLA's SAMs and Western aircraft.

The effectiveness of the PLA's SAMs against U.S. and other aircraft in the region depends on a variety of technological and operational factors. On the technological side, the aircraft's speed, maneuverability, radar cross section, and electronic countermeasures (ECM) capabilities are important factors to consider. Operationally, the aircraft's flight profile, and the employment of electronic warfare (EW) and suppression of enemy air defense (SEAD) aircraft, also contribute to or detract from survivability vis-a-vis enemy SAMs. Also, the rules of engagement (ROE), which political and military leaders impose on operational forces, have a strong influence on which tactics, techniques, and procedures can be employed.

To definitively assess the effectiveness of China's SA-10 and SA-15 force against aircraft flown in Asia requires campaign-level analysis using high fidelity analytical models and simulation to accurately measure the factors described above. However, instructional observations can be made regarding specific SAM measures of effectiveness and recent operational experience. In addition to the features discussed in the previous part of this assessment (on missile and surveillance radar range), SAM system characteristics that will challenge regional aircraft include mobility, certain command and control factors, and resistance to ECM.

Mobility. Both the SA-10 and SA-15 are mobile systems. Because it is currently difficult for other Asian and U.S. forces to detect and track most mobile systems, this feature both increases the SAM's survivability and also contributes to its effectiveness. Mobility gives the adversary greater potential for surprise, as the SAMs can be deployed to unexpected areas. The SA-15's launch vehicle's maximum speed is 40 mph, and the entire system can be readied for launch in as little as 18 minutes.[141] The SA-15 is based on a tracked vehicle, which gives it the ability to move well in rough terrain. The long-range SA-10 SAM is also a mobile system. China's S-300 PMU variant was designed specifically to improve system mobility and

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[141] *Jane's Land-Based Air Defense 1997-1998*, Jane's Information Group, London; Zaloga, Steven, "Russian Point Defense SAMs," *World Missile Briefing*, Teal Group Inc., February 2000.

reportedly can be ready for firing within five minutes of arrival at an un-surveyed site.[142] Like the SA-15, the larger SA-10 is mounted in a vehicle that gives it off-road capability. While current estimates report that the PLA has plans to deploy its SA-10s around four areas (Beijing and areas across the strait from Taiwan), this system's inherent mobility suggests that it could be speedily moved to protect other PRC assets if desired.

Command and Control. The SA-10 and SA-15 are modern systems and thus incorporate command, control, and communications capabilities that increase their effectiveness against other Asian and U.S. aircraft in Asia. These modern command and control features may enable the PLA to network otherwise disparate air defense units and meld them into an integrated system.

The SA-15's digital fire control computer processing system can automatically perform threat evaluation on up to 48 targets. Automatic track initiation can be performed on the 10 most dangerous targets, and two targets can be simultaneously engaged in all weather, day or night "irrespective of enemy ECM operations."[143] Although it is an autonomous system, it can be interfaced into an air defense network as it carries a special coded datalink for such purposes.

The S-300 system provides the PLA with even greater capability for air defense integration. The radar can track up to 180 targets simultaneously. A battery can engage up to 6 targets with 12 missiles in severe ECM environments.[144] Multiple S-300 regiments can be coordinated by a universal command, control, and communications system to integrate several air defense systems together and share target allocations. It is believed that SA-10 systems can now be netted with SA-5 and SA-12 systems and interoperate with fighter air defense zones controlling around 70 to 80 SAM launchers covering a front line of around 600 km (375 mi).[145]

Force on Force Considerations

The above discussion compared indigenous PRC and imported systems on a platform-to-platform level. However, aircraft, SAMs, and other platforms do not operate singly, but in conjunction with other components of an air force. This part of the assessment will build on the previous one, by describing some of the factors that may contribute to, or detract from, China's ability to translate their recent imports into effective combat power at the force-on-force level. The factors discussed in this part include inventory, maintenance, pilot training, air doctrine, command, control, and communications, and support from other aircraft (i.e., refueling, surveillance, and electronic warfare).

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[142] *Jane's Land-Based Air Defense 1997-1998,* Jane's Information Group, London.

[143] *Jane's Land-Based Air Defense 1997-1998,* Jane's Information Group, London.

[144] *Jane's Land-Based Air Defense 1997-1998,* Jane's Information Group, London, 137.

[145] *Jane's Strategic Weapon Systems. 1997,* Jane's Information Group, London.

Inventory. The aphorism that "quantity has a quality all its own" holds true for China's imported systems. While their quality is important, the operational utility of these systems is diminished if they cannot be employed in large numbers.

Generally speaking, attackers tend to require greater numbers than defenders. In planning ground operations for instance, a 3:1 ratio of attackers to defenders is traditionally considered the minimum required for success. Recent military operations illustrate the value of mass in air operations. In the 1991 war in the Persian Gulf (Operation Desert Storm), the U.N. coalition generated 132,029 air sorties in five months. During Operation Allied Force (the 1999 conflict in Kosovo), 37,225 combat sorties were flown in 78 days. In contrast, it will be difficult for the PLA Air Force to generate even hundreds of sorties (let alone thousands of sorties) with its modern aircraft (only around 48 Su-27s) against targets at a distance from the nearest PLA airbase. In its 1979 border conflict with Vietnam, for instance, it took the PLAAF 45 days to move 700 aircraft to the theater of operations. Once there, the PLAAF achieved an average operational tempo of only one flight for each aircraft every four days. China did not fly a single sortie over Vietnamese airspace.[146] Having about 48 Su-27s will not make a great difference in China's inability to generate numerous offensive sorties.

Table 7 compares the key platforms in the inventories of the PRC, Taiwan, Japan, and U.S. air forces stationed in the region. This table illustrates that Taiwan, for instance, has seven times more modern fighter aircraft than does the PRC. (Taiwan and Japan also have AEW and EW forces which the PLA does not. The implications of the PLA's deficiency in this regard will be discussed below.) Disregarding arguments about the Su-27's technological capabilities and assuming a rough parity between the Su-27 and modern Western fighter aircraft, the numerical inequity between the PRC's modern fighters (48) and Taiwan's modern airforce (340 fighters) brings into question the PLAAF's ability to mount effective offensive action in this scenario. However, a force of about 48 Su-27s is enough to make a tangible impact on the PRC's ability to conduct defensive operations, especially when integrated with modern air defenses.

China's procurement of four SA-10 regiments appears sufficient to make an immediate operational impact. An estimated 16-24 batteries capable of launching over 250 long-range missiles could significantly augment China's existing air defenses or enable the defense of additional assets. Also, because it is a defensive system, the SA-10 enjoys advantages over attacking aircraft, such as the ability to prepare staging and re-supply areas, and pre-survey launch sites. These advantages suggest greater operational effectiveness, which in turn, puts the pressure on the attacker to increase their numbers vis-a-vis the defenders.

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[146] Fulghum, David, "Israel Builds China's First AWACS Aircraft," *Aviation Week & Space Technology*, November 29, 1999.

Table 7. Comparison of Key PLAAF Systems with Other Key Systems

	PRC	Taiwan	Japan	U.S. Air Forces in Asia		
				CVBG*	Korea**	Japan
Modern Fighters/ Attack Aircraft	48 Su-27	150 F-16 130 IDF 60 Mirage 2000	160 F-15J/DJ	14 F-14 36 F/A-18C/D	72 F-16	36 F-16 54 F-15C/D
AAMs	AA-10 AA-11	AIM-9J/P Matra Mica Sky Sword I/II	AIM-7 AIM-9	AIM-7 AIM-9 AIM-54 AIM-120	AIM-9 AIM-120	AIM-7 AIM-9 AIM-120
AEW/ AWACS	0	4 E-2T	10 E2-C 4 E-3	4 E-2C	0	2 E-3
EW	0	2 C-130HE 2 CC-47	EP-3 1 EC-1 10 YS-11E	4 EA-6B	0	0
Aerial Refueling	~10	0	0	2 KS-3B	0	15 KC-135
Long Range SAMs missiles/ launchers (estimates)	SA-10 256-384/ 64-96	Patriot 24/6 I-Hawk 240/78 Sky Bow 465/115	Patriot 128/32 I-Hawk 200/66	0	0	0

* Yokosuka, Japan, is home port for 1 U.S. aircraft carrier, 6 surface combatants.
**U.S. Aircraft in Korea can self-deploy without refueling to Japan.
Source: *The Military Balance1999-2000*, International Institute for Strategic Studies, London.

Maintenance/Spares. Self-sufficiency has been a goal of PRC aerospace for 50 years. Yet, there is doubt even today whether China can adequately maintain the advanced aerospace systems that it has imported. Even PRC officials have claimed that the PLA Air Force "is not currently capable of flying or maintaining sophisticated foreign aircraft."[147] Clearly, the ability to maintain imported aircraft, surface-to-air and air-to-air missiles is central to their overall effectiveness. Poorly maintained equipment often does not work, does not work up to requirements, or worse yet, can severely damage itself, other equipment, or personnel. Inability to maintain modern aircraft will result in high attrition rates and exacerbate the inventory issues articulated above.

It has been reported that PRC aerospace industry is "struggling to cope with the advanced technology and industrial management methods needed to produce a state-

[147] Allen, Kenneth, Glenn Krumel, Jonathan Pollack. *China's Air Force Enters the 21st Century* (RAND, Santa Monica, CA: 1995): 141.

of-the-art fighter within the assembly process."[148] At least during the initial co-production of Su-27s, sub-standard work resulted in the first two aircraft manufactured by China to be abruptly reassembled after their first flights.

One analyst claims that China's difficulties in maintaining advanced technology result in part from poor manufacturing processes. Lacking the tight tolerances required to manufacture identical parts, PRC aircraft are literally one of a kind. "The implication is that there is no interchangeability of parts between two unique airframes of the same type of aircraft. This can be a tremendous maintenance headache involving grounding of aircraft in case of even minor unserviceabilities until inoperative parts are repaired or replacements manufactured to tailor-made specifications."[149]

China appears to have a particular deficiency in maintaining aircraft engines. Unable to maintain them in-country, the PLA has been forced to send the AL-31F engines which power both the Su-27 and the locally developed F-10 fighter to Russia for repair. China is trying to purchase from Russia a turn-key repair and maintenance facility.[150] Despite the structural obstacles in China's aircraft industry, however, Russian assistance may prove to be an important difference in the eventual full production of capable Su-27s in China.

Pilot Training. Learning how to safely and effectively operate a supersonic fighter aircraft in a modern warfare environment takes a good deal of time, resources, and effort. The standard minimum training for fighter pilots in NATO, for instance, is 180 hours a year.[151] U.S. pilots typically log more than 200 hours of in-cockpit training. Additionally, U.S. fighter pilots spend up to 70 hours a year in high quality simulators where they develop advanced skills and hone complex tactics. Western fighter pilots fly in dynamic "many versus many" engagements. They train against "aggressor squadrons," dedicated adversary pilots that fly enemy aircraft with enemy weapons and employ enemy tactics. Western pilots fly in combined arms exercises (i.e., with ground- and sea-based forces) and with multinational allies.

Many analysts criticize China's pilot training. They note that pilots spend too few hours in the cockpit and that the training they do undergo does not adequately prepare them for real combat. The PLA Air Force's Su-27 pilots have flown just 60-100 hours per year.[152] This figure is well below the NATO standard and just barely

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[148] "China-Assembled Su-27s Make Their First Flights," *Jane's Defense Weekly*, February 24, 1999.

[149] Sachdev. A.K., "Modernization of the Chinese Air Force," *Strategic Analysis*, Institute for Defense Studies and Analyses, New Delhi, September 1999.

[150] "China-Assembled Su-27s Make Their First Flights," *Jane's Defense Weekly*, February 24, 1999.

[151] Allen, Kenneth, Glenn Krumel, Jonathan Pollack. *China's Air Force Enters the 21st Century* (RAND, Santa Monica, CA, 1995): xix.

[152] Allen, Kenneth W., "PLAAF Modernization: An Assessment," in *Crisis in the Taiwan Strait*, edited by James R. Lilley and Chuck Downs, American Enterprise Institute and

(continued...)

enough training to ensure that the pilots can operate the aircraft safely.[153] Moreover, after losing several Su-27s to training accidents, each Su-27 aircraft is flown only about 10 hours monthly.[154] A major RAND study concludes that "advanced operational techniques and tactics are simply impossible to learn in so little time."[155]

The quality of the training that PLA pilots do receive has been questioned. Some have noted the heavy scripting of PLA pilot training and called it unrealistic.[156] The standard training syllabus consists of stereotyped engagements against single, non maneuvering targets. Consistent with this observation are others who claim that "almost 80-85 percent of the flying consists of plain and simple navigation sorties with marginal tactical value."[157] Finally, it appears that for all intents and purposes, once out of the cockpit, the PLA pilot's training ends. "There is virtually no simulator training, except on very rudimentary systems."[158] This lack of training affects more than the fighter pilots; it affects the quality of the whole PLA Air Force. Some have suggested that "the PLA Air Force has no capability to perform some missions, such as close air support, that are commonly assigned to the air arms of other nations."[159]

While there is consensus that PLA pilot training is below Western standards, it is unclear how far behind they really are and how long it will take them to catch up. For example, Vice Admiral Thomas Wilson, director of the Defense Intelligence Agency, testified in January 2000 that China has made improvements in its pilot training program that have resulted in much greater proficiency.[160]

Mission Emphasis and Doctrine. In many ways, China faces the same crisis that Western military planners have grappled with after the Soviet Union disintegrated. After decades of preparing to withstand a land invasion by the Soviets, China must now develop a new doctrinal underpinning that focuses its military on

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[152] (...continued)
National Defense University Press, 1997.

[153] Mann, Paul, "U.S. Military Technology Forecast to Outpace China's for Decades." *Aviation Week & Space Technology*, January 17, 2000.

[154] Brodie, Jonathan, "China Moves to Buy More Russian Aircraft, Warships and Submarines," *Jane's Defense Weekly*, December 22, 1999.

[155] Mann, Paul. "U.S. Military Technology Forecast to Outpace China's for Decades," *Aviation Week & Space Technology*, January 17, 2000.

[156] Mann, Paul, "U.S. Military Technology Forecast to Outpace China's for Decades," *Aviation Week & Space Technology*, January 17, 2000.

[157] Sachdev. A.K., "Modernization of the Chinese Air Force," *Strategic Analysis*, Institute for Defense Studies and Analyses, New Delhi, September 1999.

[158] Allen, Kenneth, Glenn Krumel, Jonathan Pollack. *China's Air Force Enters the 21st Century* (RAND, Santa Monica, CA, 1995): xix.

[159] Mann, Paul. "U.S. Military Technology Forecast to Outpace China's for Decades," *Aviation Week & Space Technology*, January 17, 2000.

[160] Wall, Robert, "CIA: China-Taiwan Clash Possible Soon," *Aviation Week & Space Technology*, February 7, 2000.

relevant roles and missions, currently centered on what it sees as its top security problem, namely, Taiwan. While there have been discussions of a new doctrine (called "local war under high-technology conditions") in military circles in China, the PLA has yet to fully develop and implement reforms.

Many analysts comment that while China has purchased new technology, it has not developed new doctrine or concepts of operation that are required to realize the potential of these new weapon systems. For instance, the same RAND study claims that "China is as far behind the West doctrinally as technologically. When a PLA Su-27 pilot is being trained only in one-on-one tail chase intercepts against non-maneuvering targets, he is being trained to waste his airplane. New equipment implies new concepts, and the PLA will need to foment a doctrinal revolution to complement the technological one if the billions to be spent on modern weapons are to pay off."[161]

Command, Control, and Communications. Western air power concepts of operation emphasize centralized planning but de-centralized decision making and execution. Initiative is fostered at low levels of command. Squadron commanders and individual pilots are allowed great freedom to improvise during operations. The success of air power in operations such as Operation Allied Force and Operation Desert Storm suggests that this philosophy has merit. In contrast, the PLAAF emphasizes centralized execution. The PLAAF has been described as "...rigid, with little flexibility for command initiative."[162] PLAAF deployment of its surface-to-air missile systems, for instance, has remained conservative and consistent over time, despite improvements in SAM capability. Almost 100 percent of PLA SAMs ring population and military centers with no attempt to aggressively cover large swaths of PRC territory. Even though recently acquired systems make new employment concepts capable, the RAND study notes "China has shown no inclination to extend its SAM coverage beyond its traditional boundaries."

The PLA's ability to command and control its air forces and air defenses effectively is influenced strongly by the quality of its communications technology. Communications systems are used to give orders, issue warnings, share information on an adversary or situation, request guidance, and generally to coordinate offensive and defensive operations.

The quality and utility of military communications systems varies considerably. At the low end of the spectrum, radios are used to broadcast voice communications between aircraft and surface based command and control assets. Digitized communications – often called data links – pass information at a faster rate, of greater quality and fidelity, and under more secure and jam resistant conditions than do voice communications. This increased capability, however, comes at the cost of increased complexity. Generally speaking, any UHF radio can communicate with another UHF radio. However, digitized communications have unique protocols and standards that must be synchronized throughout a force.

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[161] Mann, Paul, "U.S. Military Technology Forecast to Outpace China's for Decades," *Aviation Week & Space Technology*, January 17, 2000.

[162] Mann, Paul, "U.S. Military Technology Forecast to Outpace China's for Decades," *Aviation Week & Space Technology*, January 17, 2000.

Similar to EW systems, China's communications equipment is difficult to catalogue with a high degree of confidence via open sources. Technical capabilities of communications systems are jealously guarded to hamper adversary communications warfare efforts. Furthermore, communications hardware tends to be physically inconspicious and relatively easy to swap-out. However, some information is available in the unclassified realm and general comments on the PLAAF's communications capabilities can be made.

Many analysts comment that China currently lacks the skills and information technology required for a modern integrated air operations system. China's communications equipment appears limited in capability, and the PLA has been slow to digitize. Recent activity suggests that Beijing recognizes the need to improve command, control, communications, computers, and intelligence (C^4I), but its attempts to redress this deficiency are hampered by funding problems. A 1997 assessment asserted that "the current wire and radio communications equipment of the PLA is at least two generations behind that of Western countries."[163]

China's indigenous and imported fighter aircraft currently operate with a wide variety of communications equipment, which does not bode well for interoperability. The standard communications equipment on the Su-27s, for example, is a "R-800 UHF radio, R-864 HF intercom and cockpit voice recorder, SO-69 ATC transponder, and various IFF fits."[164] While the J-8 (F-8) fighter uses VHF/UHF radio and HF radios – which implies some compatibility with the Su-27, – the Q-5 and J-7 aircraft do not use UHF radios. The Q-5 and J-7 use VHF radios and Italian short wave and ultra short wave transceivers, respectively.

China indigenously manufactures a Tactical Air Defense Command and Control System (TADS) to command and guide its surface-to-air intercept systems. It has been estimated that this system is able to control up to eight automatic simultaneous interceptions, control up to 10 gun or SAM systems, and accept data from up to four radars."[165] Yet, TADS' exact means of communications is unclear, as is whether it can control SA-10 batteries. The SA-10 batteries are coordinated by two different C^3I systems (the Universal-1E C^3I system developed by the Proton NPO in Moscow, and the D4M Polyana C^3I system produced by Agat NPO in Belarus or the Baikal-1 system developed by Proton NPO.[166]). However, due to the disparate C^3I systems, it is most likely that China's air defense assets operate in a more independent than coordinated fashion. Furthermore – and more significantly from a fratricide perspective – it is unlikely that China's fighter aircraft and surface-based air defenses communicate seamlessly.

Significantly improving China's communications capabilities – especially digitized communications – will not happen overnight. Yet, recent news accounts suggest that China has taken steps that could bear fruit in several years. In January

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[163] Karniol, Robert, "Power to the People," *Jane's Defense Weekly*, July 12, 2000.

[164] *Jane's All the World's Aircraft 2000-2001*, Jane's Information Group, London:447.

[165] *Jane's C4I Systems 1996-1997*, Jane's Information Group. London: 89.

[166] Steven Zaloga. "Russian Area Defense SAMs," *World Missile Briefing*, Teal Group Inc.

2000, China was reported to have launched a military communications satellite that is to serve as the foundation of its first integrated C^4I system; called *Qu Dian*. According to this report, China claims that *Qu Dian* is analogous to the U.S. JTIDS (Joint Tactical Information Distribution System), a secure, high-capacity data communications network. The potential impact of this nascent system apparently is being debated. Some components of the U.S. intelligence community reportedly argue that, when fully deployed, the *Qu Dian* system will enable coordination and data-sharing at the joint forces level. Others in the intelligence community are said to counter that inflexibility of the PLA command structure will limit the effectiveness of the new military system.[167]

Supporting Aircraft/Missions. The fighter aircraft and other systems that China has been acquiring will not operate in isolation but as part of a larger air force. The effectiveness of the Su-27s, for instance, will depend on a large part on how well these fighter aircraft are supported by, and integrated with, any future PLA aerial refueling, airborne early warning, and electronic warfare capabilities.

Aerial Refueling. It has been reported that China has approximately10 aerial refueling aircraft.[168] China converted some B-6 (often referred to as H-6) bombers by 1996.[169] Since then, the PLA has conducted two known exercises with aerial tankers. Considering the small number of these aircraft and the apparent lack of training and limited integration with other parts of its air force, the PLA's aerial refueling capabilities in the near-term appear to be rudimentary. Equally important (and as mentioned in a previous section of this report) , it appears that the Su-27 variant China imported from Russia does not have aerial refueling capability. Furthermore, although the Su-30 fighters that China hopes to acquire do have aerial refueling capability, it is believed that they are incompatible with the B-6 refueling mechanism. Thus, in the immediate term, it does not appear that China has the ability to use their best fighter aircraft up to their full range potential. However, the longer-term implications of PLA acquisition of aerial refueling aircraft is significant, because these aircraft can greatly increase the reach and capabilities of fighter and attack aircraft.

Support from aerial tankers increase air operations effectiveness by expanding the range and payload options of attack aircraft and by keeping air superiority fighters flying combat air patrol (CAP) in the air longer. Aerial refueling also maximizes cargo aircraft capabilities important for replenishing friendly ground forces operating in distant theaters.

By refueling in the air rather than carrying extra fuel externally, combat aircraft can take off with a maximum weapon load. When air operations are measured in

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[167] Gertz, Bill, "China's Military Links Forces to Boost Power," *The Washington Times*, March 16, 2000:A1.

[168] Sae-Liu, Robert, "Chinese Expand Aerial Refueling Capability to Navy," *Jane's Defense Weekly*, June 21, 2000:14.

[169] Gertz, Bill, "Chinese Arms Buildup Increases Attack Range," *Washington Times*, March 12, 1996: 1.

terms of aircraft squadrons (12-18 aircraft), this effect is an important force multiplier. Combat aircraft with greater fuel capacity and refueling options have flexibility in choosing target routes. Also, ubiquitous fuel enables fighter aircraft to fly at higher speeds (consuming fuel at high rates) for maneuver and escape.

Air-to-air fighters on combat air patrol or escort missions benefit from aerial refueling by remaining on patrol and engaging in combat for extended periods, instead of returning to base for fuel. During Operation Desert Storm, for example, F-15s on Scud patrol were able to loiter for hours over suspected launch sites due to the approximately three refuelings each mission enjoyed.[170]

Airborne Early Warning. Despite several attempts to acquire this capability, China has not yet acquired airborne early warning aircraft. Airborne early warning, and airborne early warning and control (AWACS or AEWC^2) aircraft significantly improve the effectiveness of modern defensive and offensive air operations. AEW and AWACS aircraft provide an expanded and clearer view of the battlespace, and the ability to more coherently organize and employ large numbers of aircraft over great distances and against a large number of targets.

Because radar is usually effective only to the extent of its direct line of sight, the Earth's curvature limits the ability of surface-based radars to detect low flying aircraft at about 30 miles. Modern aircraft can travel this distance in less than a minute, eluding detection until they are literally on top of their target. By elevating early warning radars, say to 30,000 feet, low flying enemy aircraft can be detected at approximately 250 miles, providing better ability to prepare defenses and eliminate devastating surprise attacks.

AEW systems are often combined with command, control, and communications (C^3) equipment – such as identification friend or foe (IFF), electronic and communications intelligence (ELINT and COMINT), advanced navigation, and jam-resistant tactical data links. The resulting AWACS aircraft can be used not just to provide warning to defenses, but also to effectively control large numbers of aircraft on both defensive and offensive missions, over a large area against a large number of threats or targets. In sum, AWACS aircraft may be considered "force multipliers." They enable the coherent use of large numbers of aircraft over great distances against numerous threats or targets, that would otherwise operate in small groups with relatively limited operational "vision."

The military value of AEW/AWACS aircraft has been made explicit in numerous conflicts. The success of Israel, for instance, against Syrian aircraft in the 1982 Lebanon War owed much to U.S.-built E-2 Hawkeye AEW aircraft in Israeli service. E-2s routinely detected incoming Syrian aircraft at long range and vectored Israel fighters to surprise them.[171] The E-2 also enabled Israeli air attacks. In 1985, Israeli F-15s, escorted by an E-2, flew 1,500 miles to bomb PLO headquarters in Tunisia. By contrast, the British lack of AEW aircraft is considered a major contributor to the loss of two destroyers during the 1982 Falklands war. Lacking long range

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[170] Coniglio, Sergio, "Modern Air Refueling Systems," *Military Technology*, June 1991, p.93

[171] Nordeen, Lon, *Fighters Over Israel* (Orion Books, New York, NY, 1990):163.

surveillance, the British were forced to position the HMS Sheffield and HMS Coventry in defensive postures that increased their vulnerability.[172]

Electronic Warfare. China has no electronic warfare (EW) aircraft. EW aircraft, especially those systems that collect electronic intelligence and those that jam or spoof an enemy's electronic emissions, are central to modern aerial warfare. EW warfare systems protect attacking aircraft by identifying threats such as SAMs, helping to plan safer attack routes, and degrading the effectiveness of these threats if they cannot be avoided. EW aircraft can also help air superiority aircraft by providing early warning of approaching enemy aircraft. EW systems also reduce fratricide by augmenting identify friend or foe (IFF) systems.

The importance of electronic warfare is strongly suggested by recent operational experience. Air power has played a central role in the last three major conflicts in which the United States has been involved. EW aircraft have been busily and effectively protecting both offensive and defensive combat operations.

During Operation Desert Storm, only 38 allied aircraft were lost in 132,029 sorties. EW aircraft, such as the EA-6B Prowler and EF-111 Raven, flew 8,478 sorties during the war.[173] Afterwards, a senior military official reported "We have no reports that any SAM locked-up an attacking aircraft while being escorted by an EA-6B..."[174] Furthermore, a major NATO Conference after Desert Storm assessed how suppression of enemy air defenses contributed to the Gulf War: "the Joint SEAD campaign and SEAD support of the Gulf War will long be remembered as an outstanding success."[175]

During the 1995 conflict in Bosnia (Operation Deliberate Force), the NATO allies flew 17,290 sorties and suffered only two aircraft casualties.[176] The loss of the second aircraft, Captain Scott O'Grady's F-16, to a 30-year-old SA-6 SAM highlighted the need for capable EW jamming aircraft.[177] EW escorts became the

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[172] Luttwak, Edward, and Stuart L. Koehl. *The Dictionary of Modern War* (Harper Collins, New York, NY, 1991): 10.

[173] *Gulf War Air Power Survey. Vol V. Statistical Compendium and Chronology*. U.S. Department of the Air Force. Washington, DC 1993: 150.

[174] Nordwall, Bruce D., "Electronic Warfare Played Greater Role In Desert Storm Than Any Conflict," *Aviation Week & Space Technology*, April 22, 1991.

[175] *AAFCETLP Gulf War Conference Report*, 1730.13.7/AFOOAT/S-078/92, 20 Feb 1992 NATO. As reported by Williamson Murray.

[176] SFOR Air Component Fact Sheet, [http://www.afsouth.nato.int/factsheets/sforaircomponent .htm]; "2 Pilots Seized, Serb Says," *New York Times*, October 19, 1995: 12; and Sparks, Michael, "One Missile Away from Disaster," *Armed Forces Journal International*, December 1995: 18.

[177] Hitchens, Theresa, and Robert Holzer, "U.S. Extends Life of Radar-Jamming EF-111," *Defense News*, June 19-25, 1995: 3.

norm after it was determined that O'Grady did not have such support when shot down.[178] No additional aircraft were lost during this operation.

In summary, modern aerial refueling, AEW/AWACS, and electronic warfare capabilities strongly influence the effectiveness of overall offensive and defensive air operations. China's attempts to acquire these capabilities implicitly underscore their value. Until the PLA Air Force has effective aerial refueling, AEW, and EW capabilities, it will have difficulty flying its Russian-design fighter aircraft against modern air defenses or using its air defenses against attacking air forces.

Assessment of Naval Acquisitions[179]

General Considerations[180]

Scope of Discussion. This section assesses the implications of China's naval acquisitions for regional security. As requested, the discussion focuses on the implications for U.S. naval forces – notably, the U.S. forces most directly affected by these acquisitions.

Although the discussion focuses on implications for U.S. naval forces, it is important to note that China's naval acquisitions, like its naval forces generally, can also be used against other naval forces in the Western Pacific, including those of Russia, Japan, South Korea, Taiwan, the Philippines, and Vietnam. U.S. naval forces in the Western Pacific are considerably more capable than the forces of these and all other navies in the region. In general, these other naval forces (when compared to U.S. naval forces) would be more vulnerable to attack by China's Russian-made ships and submarines, and less able to attack them in turn.

A partial exception to this would be the Japanese navy, known more formally as the Japan Maritime Self-Defense Force, which is a sizeable, modern, and capable force. The Japanese fleet includes, among other things, four Aegis-equipped Kongou-class destroyers (very similar to the U.S. Navy's Aegis-equipped Arleigh Burke (DDG-51) class destroyers), more than 40 other fairly modern and capable surface combatants (equipped in part with U.S. sensors and weapons), about 18 modern and

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[178] Grant, Rebecca, "Airpower Made it Work," *Air Force Magazine*, November 1999: 34.

[179] Prepared by Ronald O'Rourke, Specialist in National Defense.

[180] Unless otherwise stated, basic information concerning the naval systems discussed in this section is taken from the following sources: Sharpe, Richard, ed. *Jane's Fighting Ships 2000-2001*. Alexandria (VA), Jane's Information Group Inc., 2000; Polmar, Norman. *The Naval Institute Guide to the Soviet Navy*. Annapolis (MD), Naval Institute Press, 1991. (5th edition); Jackson, Paul, editor-in-chief. *Jane's All The World's Aircraft 2000-2001*. Alexandria (VA), Jane's Information Group, Inc., 2000; Friedman, Norman. *The Naval Institute Guide to World Naval Weapon Systems 1997-1998*. Annapolis (MD), Naval Institute Press, 1997; Zaloga, Steven J. *World Missiles Briefing*. Fairfax (VA), Teal Group Corporation, 2000. (Briefing Book Series, updated regularly).

capable diesel-electric submarines, developed ASW capability, and more than two dozen mine warfare ships.

Compared to the U.S. Navy, however, the Japanese navy lacks, among other things, aircraft carriers with fixed-wing aircraft and nuclear-powered attack submarines. This reduces the ability of Japan's navy, compared to U.S. naval forces, to detect, track, and attack surface ships and submarines. Japan's navy also appears to have a proportionately less extensive at-sea replenishment (resupply) capability than the U.S. Navy, which could limit the ability of Japan's naval forces to operate for a sustained period of time in areas that are outside Japan's immediate home waters.

In assessing the implications of China's naval acquisition for regional security in general, the limitations of these other regional naval forces compared to U.S. naval forces should be kept in mind. This would be particularly important for crisis or conflict scenarios that might involve U.S. naval forces (either initially or from start to finish).

In addition, although parts of the discussion below are set in the possible context of a crisis or conflict involving U.S. naval forces, the section largely does not address the potential likelihood or nature of a crisis or conflict that might involve PLA, other Asian, and/or U.S. forces.

China's Navy in General. China's navy – more formally known as the People's Liberation Army Navy (PLAN) – has been primarily a coastal defense force built around ships based largely on older or obsolete Soviet technology. Since the mid-1990s, China has embarked on an effort to develop a navy with more blue-water capabilities and more modern technology. The apparent intent of this program is to develop a fleet that could challenge other Asian and U.S. naval forces during times of crisis or conflict in areas such as the Taiwan Strait, the South China Sea, the East China Sea, and (eventually) adjacent sea areas further into the Western Pacific, such as the Philippine Sea. China's acquisitions of Russian-made Sovremenny-class destroyers and Kilo-class submarines form a key part of this effort.

In assessing the potential implications for U.S. naval forces of China's purchase of modern naval systems, a key issue will be the ability of China's navy to maintain them in good working condition, operate them proficiently, and support them logistically. This, in turn, will depend on factors such as the quality, education, and training of PLA Navy personnel, the realism and sophistication of PLA naval exercises, and the capabilities of China's shore-based industrial infrastructure and at-sea logistical system.

A survey article on the PLA Navy by the U.S. naval attache to Beijing published in December 1999 provided comments bearing on a number of these issues. The article stated:

> Conscripts serve for two years. Although there are recent provisions for sailors to remain in service for up to 30 years, a cadre of senior enlisted personnel is not yet well developed. PLAN academic training remains fairly basic by Western standards; however, there is an increasing emphasis on improving the quality of training through the use of automatic-data-processing resources. Large-scale fleet

> exercises are conducted several times each year, but there is little integration between naval air and surface units, and even less integration of naval operations with units of either the PLA Air Force or Army.[181]

The article states that, along with retirements of large numbers of outdated ships and aircraft and acquisition of more modern technology, "the Chinese Navy has focused on improving training for both its officer and enlisted ranks and, in consonance with overarching PLA programs, developing a cadre of experienced noncommissioned officers," and that the navy "has relied heavily on Russian training for the officers and enlisted personnel who will man" its Sovremenny-class destroyers and Kilo-class submarines.[182] The article states that there are

> significant tactical and doctrinal shortfalls that the PLAN has not adequately addressed. At-sea sustainability is modest, and the PLAN has not yet demonstrated the ability to conduct complex coordinated air and surface operations. The training of individual sailors remains basic by Western standards, and the PLAN lacks a corps of experienced noncommissioned officers. From the highest echelons of the service to individual commands, control is highly centralized, with little flexibility and creativity in subordinate ranks.

The article also states:

> Having noted these shortfalls, however, the PLAN has made remarkable progress in its drive for modernization over the last decade. It has demonstrated the capability to deploy naval forces as far away as South America and Australia.... The complexity and scope of fleet training have steadily increased.... Further, improvements in individual training and the development of a corps of noncommissioned officers offers the potential to improve the sustainability and combat effectiveness of individual units significantly.[183]

Sovremenny-class Destroyers and Related Equipment

China's Surface Combatant Force in General. The survey article on China's navy by the U.S. naval attache to Beijing provides the following assessment of China's surface combatant force and the place of China's two Sovremenny-class destroyers in it:

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[181] Kaplan, Brad, "China's Navy Today," *Sea Power*, December 1999: 29. For other recent published overviews of China's Navy, see Ahari, Ehsan, "China's Naval Forces Look To Extend Their Blue-Water Reach," *Jane's Intelligence Review*, April 1998: 31-36, and Downing, John, "Maritime Ambition, China's Naval Modernisation," *Jane's Navy International*, April 1998: 10-12, 14-15, 17.

[182] Kaplan, Brad, "China's Navy Today," *Sea Power*, December 1999: 29.

[183] Another article states that "The current training programme comprises specifically increased emphasis on joint warfare, greater use of combat simulators on a regular basis and opposing force training in environments as close as possible to real warfare conditions." Downing, John, "Maritime Ambition, China's Naval Modernisation," *Jane's Navy International*, April 1998: 14-15.

> Although it has more than 400 fast-attack missile, patrol, and torpedo boats, the PLAN only has about 50 units that are considered major combatants by Western standards. Many of these obsolete small combatants are being replaced by more capable C-801/802 [anti-ship cruise] missile configured Houjian-, Houxin-, and Huangfen-class craft. During the 1980s, in a departure from its traditional practice of relying on Russian Navy designs, the PLAN aggressively sought to incorporate more advanced Western technology in its indigenous shipbuilding program. The acquisition of these technologies resulted in China's production of more advanced surface combatants during the past decade – including a single 6,000-ton Luhai-class guided-missile destroyer (DDG), two Luhu-class DDGs (4,200 tons), and nine Jianwei-class frigates (2,250 tons). These units are equipped with the HQ-7 or HQ-61 short-range air defense systems that will likely be replaced by a longer-range vertical-launch system within the next three to five years. These ships also have integrated tactical data systems, an improved antisubmarine warfare suite that includes embarked helicopters, and gas turbine propulsion.
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> Notwithstanding these improvements, the backbone of the PLA surface fleet remains its 16 aging Luda-class destroyers (3,250 tons) and 30 Jianghu-class frigates (1,425 tons) that are largely inadequate to meet the requirements of modern warfare. The planned acquisition of two 7,940-ton Russian-built Sovremenny-class DDGs in the 2000 to 2001 period will improve the PLAN's surface combatant capability.... The PLAN's HQ-61 and HQ-7 systems are based on the French Crotale land-based surface-to-air missile system, and they do not provide surface units with an effective area-defense capability. This deficiency makes PLAN surface units extremely vulnerable to air attack.
>
> The Chinese Navy also is limited by other operational constraints. Although it has some capability to conduct shallow water antisubmarine warfare along its littoral and in the Yellow and South China Seas, the PLAN's antisubmarine warfare capability remains modest at best. Towed-array sonar and sonobuoy systems use technology that is more than 20 years old. The PLAN's damage-control capability remains limited, and few units have automatic fire-fighting or watertight door systems. Anticontamination systems also are considered to be quite basic by Western standards. The PLAN does field a broad spectrum of fairly sophisticated sea-skimming cruise missiles – based on either Russian Styx [SS-N-2] or on French Exocet technology.... Despite this capability, the lack of effective over-the-horizon targeting sensors and coordinated targeting tactics limits the likely effectiveness of these systems.[184]

The 2000 report of the Secretary of Defense to Congress on China's current and future military strategy states:

> China's fleet of major surface combatants includes about 40 frigates and 20 destroyers. All carry ASCMs [anti-ship cruise missiles], ranging from the antiquated, first-generation CSS-N-1/SCRUBBRUSH to the more advanced C801/SARDINE and C802/SACCADE. Two Russian-built SOVREMENNY destroyers – both of which are scheduled for delivery in 2000 – will likely be equipped with the SS-N-22/SUNBURN ASCM. While most of the newer surface combatants are being equipped with short-range SAMs, the overwhelming majority

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[184] Kaplan, Brad, "China's Navy Today," *Sea Power*, December 1999: 32.

> of vessels mount no SAM system at all. Despite these limitations, the PLAN's surface fleet is expected to strive to enhance both its readiness and endurance for extended operations. In addition, it can be expected to conduct more realistic training exercises and deploy more advanced anti-ship [missiles], air defense missiles and electronic counter measures.[185]

Sovremenny Class as a Soviet 1970s-era Design. The Sovremenny-class destroyer, also known as the Project 956/956A or Sarych-class destroyer, was designed by the Soviets in the early to mid-1970s. A total of 17 Sovremenny-class ships were built for the Soviet/Russian Navy – the first began construction in 1976 and entered service in 1981, and the last began construction in 1988 and entered service in 1994. China's two Sovremenny-class ships are the 18th and 19th built by the former Soviet Union or Russia.

Sovremenny-class ships are about 512 feet long and have a full load displacement of about 7,900 tons. In terms of size and date of design, the Sovremenny-class design is roughly comparable to the U.S. Navy's Spruance (DD-963) class destroyer design.[186] The Sovremenny class was designed and built by the Soviets as part of an effort in the Cold War years of 1970s and 1980s to deploy a blue-water fleet capable of challenging the U.S. and allied naval forces for control of certain sea areas during a potential NATO-Warsaw Pact conflict.

Under the Soviets' concept of operations, Sovremenny-class ships would operate as part of integrated naval formations composed of ships with differing and complementary capabilities. The Sovremenny class, with four 130-mm (5.1-inch) guns in two twin mounts and 8 **SS-N-22 Sunburn** ASCMs, was designed with an emphasis on anti-surface warfare. The ship is also equipped with a fairly capable (by Soviet/Russian Navy standards) area air-defense system that includes the **SA-N-7 Gadfly surface-to-air missile (SAM)**.[187] The ship's ASW features, which include facilities for embarking one **Ka-27/Ka-28 Helix ASW helicopter**, are more modest – a characteristic consistent with the Soviets' intent to operate Sovremenny-class ships in naval formations that also included Udaloy-class ASW destroyers.

Intent of China's Purchase. As a 1970s/1980s-era Soviet-designed warship, China's Sovremenny-class ships are considerably more technologically modern, complex, and capable than most other PLAN surface combatants. This fact, plus China's decision to purchase two of the ships, has led some Western observers to conclude that China acquired them in large part, if not primarily, for the purpose of updating its surface-combatant technology base and accelerating its indigenous

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[185] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[186] The Spruance-class was designed in the late 1960s/early 1970s. The first ship in the class began construction in 1972 and entered service in 1975. The ships are 563 feet long and have a full load displacement of about 8,300 tons.

[187] One article states that on the first of China's two Sovremenny-class ships, "SA-N-7 Gadfly is probably the temporary fit, with [the newer] SA-N-12 Grizzly to be fitted in due course. Unconfirmed reports state that it is already fitted." Farrer, Mark. China's Navy Comes Of Age. *Asia-Pacific Defence Reporter*, April/May 2000: 31.

surface combatant design and construction efforts. Under this interpretation, one of the ships could be kept in port for purposes of studying or reverse-engineering its technology, while the other could be periodically sent to sea for purposes of gaining proficiency in operating modern surface combatants. Although China could use the ships in the near term to impress and intimidate other naval forces in the region, the primary importance of the ships under this interpretation would be to enhance China's ability to field a larger fleet of indigenously-produced modern surface combatants over the longer run.

Several articles in the defense trade press, however, have reported that China is negotiating with Russia to purchase at least two additional Sovremenny-class ships.[188] These reports, if true, suggest two possibilities. One is that China is acquiring Sovremenny-class ships not just to support a longer-run modernization effort built around indigenous designs, but to significantly improve China's capabilities in the nearer term as well. The other is that PRC officials may now have doubts about the ability of China's naval technological and industrial base to assimilate modern surface-combatant technologies and produce modern indigenous ships quickly enough to meet its longer-run naval modernization goals. If so, China may be seeking to acquire additional Sovremenny-class ships as a hedge against a potentially slow rate of progress in its indigenous shipbuilding effort.

China's Ability to Operate. Since these ships are considerably more modern and complex than most other PLAN surface combatants, they may pose a challenge to the PLAN in terms of training proficient crews, developing effective operational doctrine, and properly maintaining key systems. One recent article states that the first of China's Sovremenny-class ships "represents a logistics and support difficulty...." It also, however, states that "the Chinese have learned much from the Israeli training they have received in integrated logistic support (ILS). The Russians were reported to have been surprised by the ILS and training packages purchased [by China] with the two ships."[189]

Another article states: "Military analysts say it could take China years of training before its navy can handle such a sophisticated ship in an actual conflict.... [M]any of the weapons systems China has purchased require extensive training and sophisticated

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[188] See, for example, "Russian Anti-Ship Missile Developments," *Jane's Defence Weekly*, August 30, 2000: 26; Gertz, Bill, "Russia Readies Warship For China," *Washington Times*, July 12, 2000: 1; Farrer, Mark, "China's Navy Comes Of Age," *Asia-Pacific Defence Reporter*, April/May 2000: 31; Novichkov, Nikolai, "Four Sovremennys In Total For Beijing," *Jane's Defence Weekly*, March 15, 2000: 12; Sly, Liz, "China's New Warship Makes Waves Off Taiwan," *Chicago Tribune*, February 12, 2000; Smith, Craig S., "New Chinese Guided-Missile Ship Heightens Tension," *New York Times*, February 9, 2000; Brodie, Jonathan, "China Moves To Buy More Russian Aircraft, Warships And Submarines," *Jane's Defence Weekly*, December 22, 1999: 13; Opall-Rome, Barbara, "Economics, Russian Reluctance Slow PLA Arms Drive," *Defense News*, February 8, 1999: 9. The additional Sovremenny-class ships reportedly would be transferred directly from the Russian Navy, which would permit the ships to enter service with the PLA Navy years earlier than if the ships are built on order for China.

[189] Farrer, Mark, "China's Navy Comes Of Age," *Asia-Pacific Defence Reporter*, April/May 2000: 31.

electronics and software to be used effectively. The People's Liberation Army has not demonstrated prowess in mastering such technology."[190] A third article, paraphrasing an unnamed U.S. senior defense official, stated that "China is expected to take up to two years to fully integrate the missile ships into the Chinese Navy."[191]

Regarding China's ability to operate these ships far from home ports for extended periods of time, the survey article by the U.S. naval attache states: "The Navy's underway replenishment capability remains largely underdeveloped, and the sustainability of PLAN [naval] units is likely to be severely limited by this shortcoming."[192]

Comparison with Western Surface Combatants. Compared to modern surface combatants in the U.S. Navy and other Western navies, the Sovremenny class design, though capable, is now a somewhat older design that lacks features found in state-of-the-art surface combatants. The Sovremenny-class design, for example, includes oil-fired steam turbine engines rather than the gas turbine engines used on more recent Soviet/Russian, U.S., and European surface combatants. The Sovremenny-class design does not appear to incorporate significant shaping features for signature reduction (i.e., low observability), as certain more recent surface combatant designs do. Moreover, the Sovremenny's air-defense system, though fairly capable, is considerably less sophisticated than the Aegis air-defense system installed on U.S. Navy Ticonderoga (CG-47) class cruisers and Arleigh Burke (DDG-51) class destroyers.[193]

Capability of SS-N-22 Against Surface Ships.[194] The SS-N-22 anti-ship cruise missile, code named Sunburn by NATO and known in Russia as the 3M-80 Moskit missile, is considered by many observers to be the most threatening ship-launched ASCM in service today. Developed by Russia's Raduga missile design bureau, the SS-N-22 is a supersonic (Mach 2.5), low-flying (7 to 20 meters, or about 23 to 66 feet, above the surface of the water) ASCM that performs evasive 15-g maneuvers as it flies the final 5 to 7 kilometers (about 2.7 to 3.8 nautical miles) to its target. The missile has a range of 160 kilometers (about 86 nautical miles). It uses active and passive radar guidance and can be armed with either a 300-kilogram (660-pound)

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[190] Smith, Craig S., "New Chinese Guided-Missile Ship Heightens Tension," *New York Times*, February 9, 2000.

[191] Gertz, Bill, "China Will Get Russian Ship This Week," *Washington Times*, December 23, 1999: 1.

[192] Kaplan, Brad, "China's Navy Today," *Sea Power*, December 1999: 32.

[193] The Sovremenny's air-defense system might be more comparable to the pre-Aegis New Threat Upgrade (NTU) air-defense system installed on the U.S. Navy's now-retired Kidd (DDG-993) class destroyers and Leahy (CG-16) and Belknap (CG-26) class cruisers.

[194] For a discussion of China's purchase of SS-N-22s, see Saradzhyan, Simon, "Russians Tout Antiship Sunburn Missile for Chinese," *Defense News*, October 12-18, 1998: 28.

conventional high explosive warhead or (in the Russian Navy) a 200-kiloton nuclear warhead.[195]

If Russia sold the missiles to China with only conventional warheads, one question would be whether China would want (and be able) to design a nuclear warhead for the missile and successfully integrate it into the missile's design.[196] Equipping the SS-N-22 with a nuclear warhead would greatly increase its lethality. Although the conventional warhead on the missile is large enough so that one hit from a single missile could seriously damage or possibly even sink a U.S. Navy major surface combatant, a hit from one or possibly even a few conventionally-armed SS-N-22s might not be enough to halt flight operations on a U.S. Navy aircraft carrier because of the carrier's much larger size and its high degree of compartmentalization.[197] A nuclear-armed SS-N-22, however, could easily destroy

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[195] The characteristics of the SS-N-22 are described variously by different sources, perhaps in part because the missile has undergone improvements since it was first deployed. The description above follows that provided in the 2000-2001 edition of *Jane's Fighting Ships*. Another Jane's publication recently provided a somewhat different description of the weapon:

> The missile is powered by a solid rocket booster/ramjet sustainer combination delivering a maximum speed of M2.1 [Mach 2.1] at low altitude and a maximum range of up to 120km [about 65 nautical miles], depending on flight profile. The later 3M82 Moskit-M version is thought to extend range to 150km [about 81 nautical miles]. The weapon's Altair-designed multichannel seeker uses active radar, anti-radiation and home-on-jam modes. Approaching its target at an altitude of around 20m [about 66 feet], Moskit can execute a terminal 'S' manoeuvre (pulling up to 15g) to evade close-in defenses. The 300kg [660-pound] penetrating warhead contains 150kg [330 pounds] of high explosive. Raduga has publicised a number of further improvements to Moskit. These include more internal fuel (pushing range to 200km [about 108 nautical miles]), an improved warhead and seeker updates. (Russian anti-ship missile developments. *Jane's Defence Weekly*, August 30, 2000: 26.)

For an article discussing the SS-N-22 in some detail, see Zaloga, Steven J. Russia's Moskit Anti-Ship Missile. *Jane's Intelligence Review*, April 1996: 155-158. See also Friedman, Norman. Russians Unveil Two Missiles. *U.S. Naval Institute Proceedings*, June 1993: 107-108, and Bonsignore, Ezio. New Data On Russian Anti-Ship Missiles. *Military Technology*, No. 4, 1993: 64-66, 68-69.

[196] On this issue, one article states: "Conventions to prevent the spread of nuclear weapons, as well as Russia's own strategic interests, make it unlikely that the missiles will be delivered with nuclear warheads. But Russia could provide, or China could develop, technology that would enable the missiles to deliver a Chinese nuclear warhead." Smith, Craig S., "New Chinese Guided-Missile Ship Heightens Tension," *New York Times*, February 9, 2000.

[197] Russian marketing literature on the SS-N-22 states that 1.2 SS-N-22s are required to disable a destroyer-sized ship, while 1.5 would be required to disable a 20,000-ton troop transport ship. (Zaloga, Steven J., "Russia's Moskit Anti-Ship Missile," *Jane's Intelligence Review*, April 1996: 157; Friedman, Norman, "Russians Unveil Two Missiles," *U.S. Naval Institute Proceedings*, June 1993: 107-108.) To attack U.S. Navy aircraft carriers more successfully with conventionally armed cruise missiles, the Soviets designed the very large SS-N-19 Shipwreck ASCM, which has a 1,650-pound conventional warhead. These missiles (continued...)

a U.S. Navy aircraft carrier (and any other nearby ships), even if the warhead detonates at some distance from the carrier (which is a possibility if the missile is equipped with a so-called salvage fuze that immediately detonates the warhead if the missile is intercepted during its approach to the target ship).

The SS-N-22's designers have stated openly that the missile was developed to defeat the U.S. Navy's Aegis air-defense system. A 1993 article, for example, states:

> This author had the rare privilege of a long and open technical/operational discussion with Prof. Igor S. Seleznyov, Director of the Raduga bureau and Programme Head for the 3M-80.... Prof. Seleznyov confirmed that in the Russian Navy's view, the main interest of a highly supersonic anti-ship missile lies in exactly the same key factor as identified by Western designers and users alike – namely the sharp reduction in the time available for the target to identify the attacking missile and react accordingly....
>
> In particular, Prof. Seleznyov indicated that all the cinematic [kinematic] characteristics of the 3M-80 have been optimised for the specific purpose of overcoming the defensive barrier of the US AEGIS system. The starting point was an in-depth analysis of the AEGIS' characteristics, as regards detection range, processing speed and reaction times (I judged it indelicate to enquire about how these data were obtained), as well as cinematic characteristics of the STANDARD SM2 missile – in particular, launch acceleration, maximum manoeuvre factor and minimum engagement range. Taking it for granted that AEGIS will anyway be able to pick up an attacking 3M-80 missile at considerable distances, Prof. Seleznyov set himself the goal of designing an extremely fast, low-flying missile that would be able to breach into the target ships's inner defence zone – that is, come closer than STANDARD's minimum engagement range – before the Aegis system could complete the detection/tracking/engagement decision/missile launch/missile guidance sequence. Some simple rule-of-thumb calculations seem to show that this is indeed the case. Even admitting that the latest versions of the STANDARD missile are actually able to engage a small target flying at an altitude of 7m (which is still to be demonstrated), Prof. Seleznyov is probably correct in his belief that the Aegis system is nearly useless against a 3M-80 attack, and US ships would have no better defence than their PHALANXs.[198]

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[197] (...continued)
were installed on Russia's Kuznetsov-class aircraft carrier, Kirov-class cruisers, and Oscar-class submarines. The Kirov-class ships, with a full load displacement of about 24,000 tons, are much larger than the Sovremenny-class ships. One article, however, states: "Even one of [the SS-N-22's] conventional warheads could sink a cruiser or disable a carrier, depending on where it hits, military analysts say." (Smith, Craig S., "New Chinese Guided-Missile Ship Heightens Tension," *New York Times*, February 9, 2000.)

[198] Bonsignore, Ezio, "New Data on Russian Anti-Ship Missiles," *Military Technology*, No. 4, 1993: 66. Another article states:

> The Moskit entered development in the 1970s.... The aim of the programme was to make a major leap forward in anti-ship missile design, going from a subsonic missile to a sea-skimming missile capable of multi-Mach speeds. The rationale for the increase in speed was straight forward. By doubling or tripling the speed of
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> (continued...)

The SS-N-22 entered service in 1984 – a year after the U.S. Navy's first Aegis-equipped ship, the Ticonderoga (CG-47), entered service. As discussed in a 1984 CRS report, early congressional concerns over effectiveness of the Aegis system centered to a large degree on the ability of the system to defeat the SS-N-22, particularly since the Navy at that time did not have an air-defense target missile that could fully replicate the supersonic, low-flying flight profile of the SS-N-22.[199] The Navy's attempts over the years to develop such a target missile indigenously have met with some failures, and Navy actions in recent years to acquire appropriate target missiles have, ironically, included proposed or actual purchases of SS-N-22s themselves as well as modified air-launched Russian ASCMs known as MA-31s.[200]

The fact that the SS-N-22 was designed to defeat the Aegis system does not mean that it can. The Aegis system has undergone various improvements since it was first deployed, some of which were intended specifically to improve the system's

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[198] (...continued)

> the missile and changing the flight profile to a low-altitude approach, the reaction time of shipborne defences would be greatly reduced.... The speed and sea-skimming flight path of the new Moskit missile was intended to complicate the task of these new NATO defensive systems by substantially reducing the time in which they could react once the missile was first detected. The missile was designed to be undetectable until it crosses the radar horizon, about 18-27km [about 9.7 to 14.6 nautical miles] away from the targeted ship and only 25-35 seconds from impact. Furthermore, even if such a supersonic missile would be hit near the ship by a gun system such as [a] CIWS [close-in weapon system], there would be a high probability that debris from the missile would continue to fly forward and impact the vessel, causing considerable damage. (Zaloga, Steven J. Russia's Moskit Anti-Ship Missile. *Jane's Intelligence Review*, April 1996: 155-156.)

[199] For a discussion, see CRS Report 84-180 F, *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. Washington, 1984. (October 24, 1984) p. 10-18. See also U.S. Congress. Senate. Committee on Armed Services. Department of Defense Authorization for Appropriations for Fiscal Year 1985, Hearings Before the Committee on Armed Services, United States Senate, 98th Cong., 2nd Sess., on S. 2414, Part 8, Sea Power and Force Projection. Washington, U.S. Govt. Print. Off., 1985. p. 4309-4435; U.S. Congress. House. Committee on Armed Services. Defense Department Authorization and Oversight, Hearings on H.R. 5167, Department of Defense Authorization of Appropriations For Fiscal Year 1985 and Oversight of Previously Authorized Programs Before the Committee on Armed Services, House of Representatives, 98th Cong., 2nd Sess., Part 4 of 7 Parts, Research, Development, Test, and Evaluation – Title II. Washington, U.S. Govt. Print. Off., 1984. p. 829-846, 1241-1255.

[200] See, for example, Bohmfalk, Christian. Official: Navy Needs More Target Funding To Meet New Fleet Demands. *Inside the Navy*, September 4, 2000; Bohmfalk, Christian. Navy Launching Formal Study Whether To Buy Sunburn Missiles. *Inside the Navy*, August 28, 2000; Wall, Robert. Navy Target Win Boosts Orbital's Base. *Aviation Week & Technology*, July 10, 2000: 36; Bohmfalk, Christian. Virginia Company Wins EMD Contract To Develop Supersonic Target. *Inside the Navy*, July 3, 2000; Duffy, Thomas. Navy To But Six Russian 'Sunburn' Missiles For Foreign Test Project. *Inside the Navy*, May 15, 2000; Koch, Andrew. Boeing Poised To Convert Russian Drones For USN. *Jane's Defence Weekly*, November 10, 1999: 14; Mulholand, David, and Simon Saradzhyan. Boeing To Buy Russian Missile for Navy Tests. *Defense News*, October 11, 1999: 4, 27.

ability to defeat the SS-N-22 and other fast, low-flying missiles. The ability of Navy ships to defeat missiles like the SS-N-22 is being further improved by deployment of the Cooperative Engagement Capability (CEC), which is a system that allows ships and aircraft to share and fuse their radar data on air-defense targets on a continuous and real-time basis and permits ships to shoot and guide air-defense missiles using data from other CEC-equipped platforms.[201]

Even with these improvements, however, the SS-N-22 missile probably remains a challenging missile for the Aegis system. A 1993 article about U.S. attempts to purchase some of the missiles for use as targets quoted an unnamed Navy official as saying, "This missile is a source of great concern to the Navy" because of its speed.[202] Ships equipped with an Aegis system (or some other rapid-reaction air-defense system) might not be able to guarantee 100 percent effectiveness in defending themselves against the missile, and ships not so equipped would be highly vulnerable to the missile unless they operate under the protective cover of an Aegis-equipped ship. A 1996 article states:

> The Moskit has the [export] advantage of being the only major ship-launched supersonic anti-ship missile on the market for years to come.... The likelihood of widespread proliferation of the Moskit has already energized the ship-defence field.... Many European firms are offering new generations of terminal-defence gun systems, as [the U.S.-made] Mk 15 CIWS Phalanx is viewed in many quarters inadequate to deal with the Moskit. A number of missile defense programmes are underway such as NATO's Enhanced Sea Sparrow Missile (ESSM) which is aimed at deploying enhanced manoeuvring [sic] missiles capable of dealing with the Moskit's high-speed terminal evasive trajectory. Finally, various passive electronic defences are being examined as an alternative to hard-kills. Without a doubt, the Moskit remains the benchmark against which all future shipborne defensive systems will be judged over the next several years.[203]

Longstanding concerns about the effectiveness of the air-defense systems of U.S. Navy ships against potential adversary ASCMs were recently underscored by a GAO

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[201] For an introductory discussion of CEC, see CRS Report RS20557, *Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress*, by Ronald O'Rourke. Washington, 2000. (Updated regularly) 6 p.

[202] Mintz, John. Sweating Out The 'Sunburn'. *Washington Post*, June 13, 1993: H1, H4-H5.

[203] Zaloga, Steven J. Russia's Moskit Anti-Ship Missile. *Jane's Intelligence Review*, April 1996: 158. The final sentence in this passage might soon be overtaken by events, as the Russians are now marketing to China, India, and other potential buyers a missile known as the SS-N-27 Novotar Alpha or 3M54 that some observers believe to be at least as capable as the SS-N-22. In addition, another Russian missile roughly comparable to the SS-N-22 – the Yakhont or SS-NX-26 – is reportedly completing development and is now available for export. (Zhang, Yihong. China Negotiates To Buy Advanced Russian Anti-Ship Missile. *Jane's Defence Weekly*, August 9, 2000; Russian Anti-Ship Missile Developments. *Jane's Defence Weekly*, August 30, 2000: 26.)

report that significantly criticized as inadequate the Navy's plans for upgrading the air-defense systems of its various ships.[204]

Vulnerability of Sovremenny-class Design to Attack. China's Sovremenny-class ships, though fairly capable, would be vulnerable to U.S. air and submarine attack.

Vulnerability to Air Attack. The Sovremenny-class air defense system is described in reference sources as capable of engaging as many as six enemy targets at once with its SA-N-7 SAM system. Published performance data on the SA-N-7 suggests that it is broadly similar to earlier (1970s/1980s) versions of the U.S. Navy's Standard air-defense missile. Targets penetrating the ship's SA-N-7 defenses can be engaged by the ship's four radar-controlled 30-mm AK 630 close-in weapon system (CIWS) Gatling guns. These are broadly similar to the U.S. Navy's 20-mm Phalanx CIWS but may have more stopping power due to their use of the larger 30-mm round. The ship's air-defense system also includes chaff launchers and electronic countermeasures (ECM) systems for diverting incoming guided missiles.

This air-defense system, though fairly capable, is nevertheless based on 1970s-era Soviet radar and computer technology and thus is limited in what it can accomplish. The ship uses an older-style rotating air search radar rather than a more capable phased-array air search radar like the SPY-1 radar on U.S. Navy Aegis ships. The various parts of the Sovremenny-class's air-defense system may not be as fully integrated and automated as those on an Aegis ship; consequently, the system's reaction time may be slower than that of an Aegis ship. Also, the system might have only a moderate or limited ability to operate in the presence of enemy jamming or countermeasures.

In addition, given the more limited air-defense capabilities of most of China's other surface combatants, China's Sovremenny-class ships, at least for the next few years, may not gain much added protection against air attack from any other PLAN ships that might be operating nearby. The Secretary of Defense's report to Congress on China's current and future military strategy states:

> Currently, the PLAN's surface [naval] units are ill equipped for air defense, particularly ASCMs. Only a handful of the PLAN's approximately 60 destroyers and frigates are equipped with SAMs; the remainder are outfitted with anti-aircraft guns of various calibers. The few existing SAM systems have extremely limited ranges and are useful only for point defense [i.e., defense of the ship on which they are installed, but not of other ships in the area]. No long-range shipborne SAM systems currently exist in the inventory. China is reportedly seeking to address its naval air defense shortcomings through the development of a naval variant of the HQ-9 SAM. The PLAN has already deployed – albeit in limited numbers – a naval variant of the HQ-7. The SA-N-7 system which will be acquired from Russia as part of the SOVREMENNY destroyer deal is a modern, medium-range

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[204] U.S. General Accounting Office. *Defense Acquisitions: Comprehensive Strategy Needed to Improve Ship Cruise Missile Defense.* Washington, 2000. (July 2000, GAO/NSIAD-00-149) 54 p.

naval SAM system; however, it will have only a limited capability against cruise missiles.[205]

In light of these considerations, the Sovremenny-class design imported by China would likely be vulnerable to a U.S. coordinated air attack employing multiple weapons arriving at about the same time, particularly weapons with a stand-off range greater than the approximate 15-mile range of the SA-N-7. The U.S. Navy has had many years to study the Sovremenny-class's air-defense system and in all likelihood has developed tactics for saturating and overcoming it, particularly when the ship is not operating in the company of other ships with capable air-defense systems.

Air-launched weapons that could be used in such an attack include the High-Speed Anti-Radiation Missile (HARM), the air-launched version of the radar-guided Harpoon anti-ship cruise missile, and the air-launched Standoff Land Attack Missile (a version of the Harpoon with man-in-the-loop terminal guidance that, in spite of its name, can be used against surface ships). Potential surface-launched weapons that could be used, depending on the tactical situation, include the surface-launched version of the Harpoon missile, the Standard missile (as used in its lesser-known surface-to-surface mode), and the anti-ship version of the Tomahawk cruise missile (if any are available[206]).

Vulnerability to Submarine Attack. As noted earlier, the Sovremenny-class design is equipped with only a modest ASW capability. The design's ASW systems include a hull-mounted medium frequency sonar, two short-range ASW mortars for launching small anti-submarine munitions or torpedo countermeasures, four torpedo tubes for launching 21-inch diameter torpedoes, and facilities for embarking one Ka-27/Ka-28 Helix ASW helicopter. The Ka-27/Ka-28 was developed in the 1970s and first entered service in 1982. The Ka-27 is the basic version; the Ka-28 is the export version. China's purchase included 3 Ka-27s and 5 Ka-28s. The helicopters are equipped with a dipping sonar and a magnetic anomaly detector (MAD). They can also carry up to 36 sonobuoys or a single ASW torpedo, a single ASW rocket, two bombs, or 10 depth charges. When operated in pairs, one is normally used to track the hostile submarine while the other drops depth charges.[207]

Although these systems give the Sovremenny-class design some ASW capability, a more capable ASW system would have included a low-frequency (i.e., longer-range) hull-mounted sonar (rather than a medium-frequency hull-mounted sonar), an additional variable-depth or towed-array sonar, a ship-launched ASW rocket for rapidly delivering a depth charge or lightweight ASW torpedo to a longer range than the ASW mortars, and facilities for embarking two ASW helicopters rather than one. The capability of the ASW system on the Sovremenny-class design would be further

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[205] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

[206] Many Tomahawk anti-ship missiles are being converted into Tomahawk land attack missiles.

[207] The radar on the helicopter can also be used to provide targeting data for the ship's SS-N-22 missiles.

limited by its 1970s-era sonar signal-processing computers and accompanying algorithms, unless these have been updated.

The limits of the ASW system on these ships could be compounded by a lack of proficiency on the part of PLAN crews in operating these systems to their fullest potential. ASW is a notoriously difficult operational skill to master and maintain. Even Western navies, with their well-educated and highly trained crews, sometimes find it challenging to achieve and maintain operational proficiency in ASW.

Given the limited ASW capabilities of the rest of the PLA Navy, China's Sovremenny-class ships may not gain much added protection against submarines from other PLAN platforms. ASW is often best pursued as a team effort by multiple air, surface, and submarine platforms operating as part of a broader ASW network. Without the benefit of such a team effort, even a ship with a highly capable ASW system might find it difficult, depending on the tactical situation and environmental conditions (e.g., local acoustic conditions), to detect a hostile submarine in a timely manner and maintain a reliable track on it. In this connection, it is worth recalling that the Sovremenny-class design was originally intended by the Soviets to operate in conjunction with Udaloy-class ASW destroyers and other Soviet ASW platforms.

In light of these considerations, the Sovremenny-class design acquired by the PLAN would likely be very vulnerable to attack by one or more U.S. Navy attack submarines. The U.S. Navy attack submarine fleet has had many years to study the ASW weaknesses of the Sovremenny-class design and likely has developed tactics for approaching and attacking it with minimum risk of being detected, particularly when the ship is not operating in the company of other ASW platforms. Indeed, it is conceivable that U.S. Navy attack submarines have accumulated considerable experience since the early 1980s in covertly tracking and targeting Sovremenny-class ships. It is sometimes said, only half in jest, that U.S. submariners divide the world's ships into two categories – submarines and targets. It is quite possible that U.S. Navy submariners would rank China's Sovremenny-class ships, particularly when not operating in the presence of supporting ASW platforms, as potentially highly vulnerable "sitting ducks."

U.S. submarine-launched weapons that could be used against the Sovremenny-class design include the submarine-launched version of the Harpoon anti-ship cruise missile and the Mk 48 21-inch diameter heavyweight torpedo. Surface combatants are highly vulnerable to torpedoes exploding below their hulls – the shock waves from such explosions can break the ship's keel and quickly sink it.

Conducting a submarine attack against a Sovremenny-class ship would not be as simple a proposition as it was for the British attack submarine Conqueror when it attacked and sank the Argentine cruiser Belgrano in the 1982 Falklands/Malvinas war. Unlike the Belgrano, which had virtually no ASW capability and was steaming in isolation, the Sovremenny-class design does have some ASW capability and could be operating in the company of other PLAN platforms with at least some (albeit limited) additional ASW capability. A U.S. Navy attack submarine would thus have to conduct operations with some degree of care and skill, particularly so as to ensure its ability to evade possible counterattack after launching its weapons. Still, U.S. Navy attack submarines have been trained to conduct such attack missions for many years.

Potential Tactical Implications. Given the capabilities of the SS-N-22 missile and the vulnerability of China's Sovremenny-class ships to U.S. air and submarine attack, the threat that China's Sovremenny-class ships might pose to U.S. Navy surface ships in a crisis or conflict would appear to depend on the scenario in which the Sovremenny-class ships engaged U.S. forces.

If a crisis involving China and the United States develops in a way that provides U.S. forces with some warning of an impending PLA attack, U.S. national intelligence-gathering systems and U.S. naval forces operating in or near areas where PLAN forces operate could continuously track the location of the Sovremenny-class ships. In addition, U.S. naval forces could prepare to launch a rapid air or submarine attack against the ships should the crisis develop into a conflict, keep U.S. surface ships at a distance from the Sovremenny-class ships, attempt to use cover, concealment, and deception so as to confuse PLA forces as to the location and identity of U.S. surface ships, orient U.S. ships so as to maximize their ability to defend against any SS-N-22s approaching from the potential general direction of attack, and place the air-defense systems of U.S. surface ships on high-alert status. This would put U.S. forces at a strong advantage. At the outbreak of hostilities, it could lead to the disabling or destruction of the Sovremenny-class ships before they could fire many (or any) of their SS-N-22 missiles while maximizing the chances of defeating any SS-N-22s that are launched.

If, on the other hand, the crisis develops in a way that provides U.S. forces with little or no warning of an impending PLA attack, and if U.S. surface ships are operating within range of the SS-N-22, this could put U.S. forces at a potentially strong disadvantage. If China uses its Sovremenny-class ships to carry out a no-warning attack with SS-N-22 missiles against unalerted nearby U.S. surface ships, then there is a significant possibility that the Sovremenny-class ships would succeed in launching at least some, if not all, of the SS-N-22s they intended to launch before being counter-attacked by U.S. forces, and a not-insignificant chance that one or more of these missiles would hit and significantly damage one or more U.S. surface ships. A November 1999 article quoted a retired U.S. Navy admiral as stating that "The scariest scenario is the first-shot theory.... If Beijing decided to take a potshot at a (U.S. aircraft) carrier, this missile would give us something to worry about."[208]

During the Cold War, this second scenario – a no-warning, close-quarters attack by a cruise-missile-armed ship – was a particular concern to U.S. naval planners, because U.S. naval forces that were forward-deployed to the Mediterranean frequently operated in close proximity to – and were often trailed by – Soviet ships armed with ASCMs. In the 1970s, the Soviets modified some of their Kashin-class destroyers to include four aft-facing ASCMs. Some Western analysts believed this modification was done specifically so that these ships could conduct a no-warning, close-quarters attack at the outset of a NATO-Warsaw pact conflict and then quickly attempt to leave the area.

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[208] Slavin, Barbara, and Steven Komarov, "China's Military Upgrade May Raise Stakes in Taiwan," *USA Today*, November 19, 1999: 16. The retired admiral being quoted was Rear Admiral Eric A. McVadon, who served as the U.S. defense and naval attache in Beijing in 1990-1992.

A key issue for U.S. military planners and policymakers is the likelihood of a no-warning, close-quarters attack by China's Sovremenny-class ships against U.S. Navy surface ships. Under what circumstances might U.S. Navy surface ships be required to operate in close proximity to China's Sovremenny-class ships, and to what degree are those circumstances consistent with the scenario of a no-warning attack? During the Cold War, the United States forward-deployed naval forces to the Mediterranean on a continuous basis, and Soviet naval forces deployed there frequently as well. It was thus a common (and often unavoidable) circumstance for U.S. naval forces to operate in proximity to Soviet naval forces in the Mediterranean. The U.S. Navy, however, normally does not continuously deploy surface ships to China's primary blue-water naval operating areas, and China's Sovremenny-class ships deploy to those waters on only an occasional (as opposed to continuous or near-continuous) basis. Thus, instances of U.S. surface forces operating in proximity to Sovremenny-class ships are probably infrequent. Moreover, if China attacked U.S. surface ships with SS-N-22s as part of a broader attack on U.S. forces in the area, preparations for this broader attack might be detected by the United States, permitting U.S. Navy surface ships to take preparatory defensive measures. In this sense, a no-warning, close-proximity attack by SS-N-22s on unalerted nearby U.S. Navy surface ships would appear to be an unlikely scenario.

It is not, however, a scenario that can be ruled out, particularly if China decides than an SS-N-22 attack conducted in the absence of other military activities would serve some political or military purpose. China could, for example, deliberately conduct a no-warning SS-N-22 attack against a U.S. Navy surface ship to either highlight the capabilities of the SS-N-22, embarrass United States by demonstrating the vulnerabilities of U.S. Navy ships, or exact retribution for the U.S. attack on the PRC embassy in Yugoslavia during Operation Allied Force.

Following the attack, China could claim that it was either an accidental missile launch (like the October 1992 accidental U.S. Navy missile attack on a Turkish destroyer[209]), a case of mistaken target identity (like the U.S. attack on the PRC

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[209] The incident, which occurred in the Aegean Sea, involved two Sea Sparrow air defense missiles that were launched from the U.S. aircraft carrier Saratoga when crew members mistook a surprise air-defense drill for an actual attack on the ship. One of the missiles hit the bridge of the Turkish destroyer Muavenet, killing 5 persons (including the commanding officer) and injuring 15 others. Gellman, Barton. U.S. Missile Hits Turkish Destroyer. *Washington Post*, October 2, 1992: A1, A45; Seper, Jerry. Carrier Missile Hits Ship. *Washington Times*, October 2, 1992: A1, A6; Gellman, Barton. Navy Blames Accident on Crew Error. *Washington Post*, October 3, 1992: A1, A6; Schmitt, Eric. Navy Seeks Cause of Errant Missile. *New York Times*, October 3, 1992: 2; Gellman, Barton. Navy Missile Used Halted Pending Incident Probe. *Washington Post*, October 4, 1992: A8; Schmitt, Eric. Navy Deactivates Sparrow Missile in Inquiry. *New York Times*, October 5, 1992: A6; Faram, Mark D. Costly Mistake: Missile Kills 5. *Navy Times*, October 12, 1992: 4; Saratoga Missile Incident Blamed on Human Error. *Washington Post*, November 27, 1992: A10; Gordon, Michael R. Drill Mistaken for Actual Attack Led to U.S. Firing on Turkish Ship. *New York Times*, November 28, 1992: 1, 6; Gellman, Barton. Saratoga Missile Firing Seen As Accidental; 7 Disciplined. *Washington Post*, December 2, 1992: Pexton, Patrick. 'A Failure to Communicate': Why Saratoga Fired on Turks. *Navy Times*, December 14, 1992: (continued...)

embassy, the July 1988 U.S. Navy downing of an Iranian airliner in the Persian Gulf,[210] or – as Iraq claimed – its May 1987 attack on the U.S. Navy frigate Stark in the Persian Gulf.[211]), or an attack based on a mistaken understanding of the target's nature or actions (like the U.S. Navy downing of the Iranian airliner,[212] or – from Sudan's perspective – the punitive August 1998 U.S. Navy Tomahawk cruise missile attack on what turned out to be a pharmaceutical plant in Sudan).

Kilo Class Submarines

China's Submarine Force in General. The survey article on China's navy by the U.S. naval attache in Beijing provides the following assessment of China's submarine force and the place of its four Kilo-class submarines:

> Although it deploys a force of more than 60 submarines, PLAN units lag behind Western standards, and most weapons and sensor systems are based on older Russian technology. Lack of crew proficiency and hull quieting remain significant problems, and acoustic systems are two to three generations behind the world's first-line units. All units can carry either torpedoes or mines, and the acquisition of wake-homing torpedo technology has significantly improved the PLAN's submarine antisurface capabilities. As the PLAN modernizes, it is phasing out its fleet of more than 30 older Romeo-class conventional diesel submarines, replacing them with indigenously produced Ming- (19 units) and Song- (3 units) class [boats], or Russian-built Kilo (type 877 and 636) submarines.
>
> The PLAN's four Kilo units remain the submarine force's most capable boats, although the capability of their crews to operate them effectively in a tactical environment is suspect. The PLAN's continuing reliance on Russian-built hulls reflects the lack of success of [the] indigenous Ming and Song designs, and this situation is likely to continue as the Navy pursues acquisition of advanced air-independent propulsion systems [for its non-nuclear-powered submarines]....
>
> Given its slow progress with indigenously produced [nuclear-powered] submarine units, as well as the prohibitively high construction costs, the PLAN is likely to

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[209] (...continued)
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[210] Crew members aboard the Navy ship, the Aegis cruiser Vincennes, believed the airliner was an Iranian F-14 fighter.

[211] Although Iraq's Exocet cruise-missile attack in 1987 against the U.S. Navy frigate Stark was officially explained by Iraq as an accident, there was some speculation that it was a deliberate act by Iraq intended either to draw the United States into the Iran-Iraq war or punish the United States for selling arms to Iran. Most of those who considered the incident in detail, including the House Armed Services Committee, appear to have concluded that it was not a deliberate attack. For a discussion, see Levinson, Jeffrey L., and Randy L. Edwards. *Missile Inbound, The Attack on the Stark in the Persian Gulf.* Annapolis (MD), Naval Institute Press, 1997. p. 110-115.

[212] Crew members aboard the Vincennes believed the aircraft was descending as it approached the ship, as if it were getting ready to launch a weapon. In fact, the airliner was climbing as its flight path took it near the ship.

> emphasize acquisition of cheaper, more efficient, and less complex conventional submarines.[213]

The 2000 report of the Secretary of Defense to Congress on China's current and future military strategy states:

> China's subsurface warfare capabilities are modest compared with Western standards, but they are considered effective against most other East Asian navies. The PLAN's equipment is less sophisticated, older, and noisier. Its personnel are undereducated, the senior enlisted concept is new, and training and exercises lack realism. China currently has access to a wide variety of technology sources and actively engages in technology transfer to further its antisubmarine warfare (ASW) programs. As China combines domestic research and development with submarine-related technology acquired through direct purchase and transfer from foreign countries, particularly Russia, China's ASW capabilities are expected to improve over time.
>
> The acquisition of four KILO attack submarines from Russia reportedly has provided the PLAN with access to technology in quieting and sonar development, as well as weapon systems. China can be expected to try to incorporate some aspects of these technologies into its domestic submarine construction programs, although it will take the navy many years before it can use effectively the advanced technology now available....
>
> Although the [submarine] force is oriented principally toward interdicting surface ships using torpedoes and mines, China is expected to begin arming some [of] its submarines with submerged-launch cruise missiles. The capability of Chinese submarines to conduct ASW operations is expected to improve, particularly in light of the acquisition of Russian-built Kilo-class submarines and the greater emphasis reportedly being placed on ASW training. As a result, China's submarine fleet could constitute a substantial force capable of controlling sea lanes and mining approaches around Taiwan, as well as a growing threat to submarines in the East and South China Seas.[214]

Kilo Class as a Late 1970s-era Design. The Kilo-class diesel-electric submarine, also known as the Project 877/636 or Vashavyanka-class submarine, was designed by the Soviets in the late 1970s. A total of about 24 Kilo-class boats were built for the Soviet/Russian Navy, of which 12 remain in service. Additional Kilos were built for export to Algeria (2 boats), China (4 boats), India (10 boats), Iran (3 boats), Poland (1 boat), and Romania (1 boat). The first Kilo was launched in 1979-1980 and entered service with the Russian navy in 1982.

Kilo-class boats are about 242 feet long with a maximum beam (diameter) of about 32.5 feet and a submerged displacement of 3,076 tons. In terms of date of design, the Kilo-class is roughly comparable to the Dutch Walrus-class design or the

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[213] Kaplan, Brad, "China's Navy Today," *Sea Power*, December 1999: 31.

[214] Secretary of Defense, "Report on the Military Power of the People's Republic of China," Report to Congress Pursuant to the FY2000 National Defense Authorization Act, June 2000.

Japanese Yuushio-class design.[215] In terms of size, the Kilo-class design is one of the world's larger diesel-electric submarines[216] and is roughly comparable to the Walrus-class design, Australia's Collins-class design, or Japan's Oyashio- or Harushio-class designs.[217]

The Kilo-class design is usually divided into two basic variants – the Type 877 and the Type 636. The Type 877 is usually described as the basic version; the Type 636 is usually described as an improved version with quieter propulsion and a more capable fire-control system. Until recently, Russia exported only Type 877 boats while reserving Type 636 boats exclusively for its own use. This pattern was broken when Russia agreed to sell China two Type 636 boats as the second part of China's four-boat purchase. Russia may have also sold a Type 636 boat to India as the final boat in India's 10-boat purchase.

At least three variants of the Type 877 are now recognized – the basic Type 877, the 877K, and the 877M. The K variant includes an improved fire-control system while the M variant is equipped to fire wire-guided torpedoes from two of its tubes. In addition, export versions are designated with the letter E. China's two Type 877 boats are described as 877EKMs.[218]

The Kilo-class design is equipped with six 21-inch diameter torpedo tubes and can carry a total of 18 torpedoes (6 in the tubes and 12 reloads in the torpedo room) of various types, including wake-homing torpedoes. In lieu of torpedoes, the Kilo-class design can also carry 24 mines or (possibly in the future) submarine-launched ASCMs.

The Kilo-class design has a diving depth of 790 feet, a cruising or transit range of 6,000 nautical miles at 7 knots using snorkeling, and a stealthy patrol or tactical range of 400 nautical miles at 3 knots when submerged and operating on batteries. The Kilo is usually described as a quiet or very quiet submarine when operating on batteries. Graphs published by the U.S. Navy's Office of Naval Intelligence in 1996 show that at tactical speeds of 5 to 7 knots, a Type 877 Kilo is as quiet in terms of broadband noise as a German-made Type 209 diesel-electric submarine, while a Type 636 Kilo is as quiet as an Improved Los Angeles (SSN-688) class nuclear-powered

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[215] The first Walrus-class boat was laid down in 1979 and launched in 1985. (A serious fire delayed its entry into service until 1992.) The first Yuushio-class boat was laid down in 1979, launched in 1981, and commissioned into service in 1982.

[216] Most modern diesel-electric submarines in operation today are smaller than the Kilo-class design. Most versions of the widely exported German-made Type 209 submarine, for example, are about 183 to 200 feet long with a maximum beam of about 20.3 feet and a submerged displacement of about 1,200 to 1,600 tons.

[217] The approximate lengths (in feet), maximum beams (in feet) and submerged displacements (in tons), respectively, of these designs are as follows: Walrus (223, 27.6, 2,800), Collins (255, 25.6, 3,353), Oyashio (268, 29.2, 3,000) and Harushio (253, 32.8, 2,850).

[218] Iran's three Kilos are 877EKMs, while India's Kilos (except possibly the last one) are 877EMs.

attack submarine (SSN) – and quieter than either a basic Russian Akula-class SSN, a British Trafalgar-class SSN or a basic Los Angeles-class SSN.[219]

The Kilo-class submarine, like most other diesel-electric submarines, was designed to help the operating country defend its home waters against an attempt by opposing naval forces to enter, operate in, and establish control over those waters. Kilo-class submarines can also be used for other classic submarine missions, such as interdicting merchant ships and enforcing a blockade, conducting covert intelligence, surveillance and reconnaissance (ISR) operations, and covert insertion and recovery of special operations forces.

Intent of China's Purchase. China's intent in purchasing Kilo class boats could be essentially the same as its intent in purchasing Sovremenny-class destroyers. As a 1970s-era Soviet-designed submarine, China's Kilos-class boats are considerably more technologically modern, complex, and capable than China's obsolescent Romeo-class boats. This fact, plus China's decision to purchase two Type 877s and two Type 636s, has led some Western observers to conclude that China acquired them in large part for the purpose of updating its submarine technology base and accelerating its indigenous submarine design and construction efforts. Under this interpretation, for either the Type 877 or the Type 636, China could keep one boat in port for purposes of studying or reverse-engineering its technology, while the other could be periodically sent to sea to gain proficiency in operating modern diesel-electric submarines.

As with the Sovremenny-class acquisition, however, articles in the defense trade press have reported that China may be negotiating with Russia to purchase one or more additional Kilo-class subs. Such reports, if correct, again suggest either that China might be acquiring Kilos to significantly improve China's submarine capabilities in the nearer term, or that PRC officials may now have doubts about the ability of China's naval technological and industrial base to assimilate modern submarine technologies and produce modern indigenous boats quickly enough to meet its longer-run naval modernization goals.[220]

A group of four capable submarines – unlike a group of two capable surface combatants – can by itself easily constitute an operationally effective combat force in operations against a large and capable opposing navy. Submarines, unlike most surface ships, are designed to operate effectively in combat as individual units, without support from other platforms. Even one capable, well-operated submarine can pose a significant tactical concern for an opposing naval force, even one with ample ASW assets and training.[221] In this sense, China's acquisition of Kilo-class

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[219] U.S. Department of the Navy. Office of Naval Intelligence. *Worldwide Submarine Challenges, 1996*. Washington, 1996. (February 1996) p. 11.

[220] For discussions of the difficulties China has experienced in its indigenous submarine construction programs, see Corliss, Josh, "China Looks To Second Song Class For Solution," *Jane's Navy International*, October 1999: 9; Sae-Liu, Robert, "Second Song Submarine Vital To China's Huge Programme," *Jane's Defence Weekly*, August 18, 1999: 17.

[221] A case often cited in support of this argument is the considerable difficulty experienced by (continued...)

submarines, perhaps more than its purchase of Sovremenny-class destroyers, may reflect as much a desire to improve China's naval capabilities in the nearer term as it does a desire to provide a technological foundation for improving them in the longer term.

China's Ability to Operate. China reportedly has experienced difficulty keeping its Kilos in good working condition, and some additional difficulty in training proficient crews to operate them. Some of China's difficulties in keeping the boats in operational condition have been due to the Kilos' batteries, which have caused problems for other Kilo-operating countries, particularly Iran and India.[222] The PLAN, however, has also experienced other problems as well. One press report states: "Two of the Kilos were out of service for lengthy spells because of electrical and engine problems caused by faulty maintenance, for example."[223] Another states:

> Two of the first three Chinese Kilos were seriously damaged through inadequate training but have since been repaired.... The best personnel on these three boats have been combined to crew the fourth vessel, whose performance shows significant improvement. Additional training is underway but the PLAN will still not take the Kilos below a depth of 50m [about 164 feet].[224]

An earlier report states that:

> the Chinese submarine force has had severe difficulties operating the first Project 636 [boat] that it received last year [1997] because of a lack of trained personnel. The navy sent only a small number of officers to Russia to train on the Project 636 [boat] and intended to fill the rest of the crew with personnel who were proficient on the two less advanced Project 877EKM submarines that the PLAN acquired from Russia in 1995. However, when the PLAN received the Project 636 [boat], it discovered that the vessel was significantly different from the earlier class and its Project 877EKM crew were not qualified to handle the vessel. Adding to its difficulties, one of the two Project 877EKMs has been out of operation for more than a year because of generator problems.[225]

Comparison with Western Submarines. Although the basic Kilo-class design dates to the 1970s and is referred to as "elderly" by *Jane's Fighting Ships*, the design

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[221] (...continued)
the British Navy during the 1982 Falklands/Malvinas war in countering the San Luis, Argentina's one operational German-made Type 209 submarine.

[222] One press report states that China's Kilos "have proved troublesome, with batteries that have a very short life." Saradzhyan, Simon, "Russia Ponders Selling Nuclear Submarines To China," *Defense News*, September 27, 1999: 26.

[223] Brodie, Jonathan, "China Moves To Buy More Russian Aircraft, Warships And Submarines," *Jane's Defence Weekly*, December 22, 1999: 13.

[224] Sae-Liu, Robert, "Second Song Submarine Vital To China's Huge Programme," *Jane's Defence Weekly*, August 18, 1999: 17.

[225] "New PLAN To Train, Purchase Vessel Mix," *Jane's Defence Weekly*, December 16, 1998: 25. See also "Two Of China's Kilos Are No Longer in Operation," *Jane's Defence Weekly*, September 2, 1998: 17.

remains a fairly capable one by Western standards. The Kilo appears to be comparable to larger Western diesel-electric submarines in terms of number of torpedo tubes, total number of torpedo-sized weapons, diving depth, and range. And as mentioned earlier, the Kilo-class design is also quiet by Western standards.

As a Soviet-designed submarine, the Kilo-class design has features intended to give it more ability to withstand attack than standard Western submarines. The Kilo-class design has a reserve buoyancy of 32 percent (a much higher figure than for typical U.S./Western submarines) and a pressure hull with multiple compartments. As a result, the Kilo-class design might have a better chance than a Western submarine of surviving a hit by an enemy torpedo, particularly a lightweight (12.75-inch diameter) surface- or air-launched torpedo. Even if it survives such a hit, however, a Kilo-class boat might no longer be able to conduct effective combat operations.

Although their fire-control systems have been updated, China's Kilo-class submarines may not be as advanced and capable in terms of their combat systems as newer U.S. or Western submarines. Nor are Kilos equipped with the air-independent propulsion (AIP) systems that are now being fitted on state-of-the-art Western non-nuclear-powered submarines, which will give non-nuclear-powered boats a low-speed submerged endurance greater than that of standard diesel-electric submarines, like Kilos-class boats.

As diesel-electric submarines, Kilo-class boats have much less submerged endurance than nuclear-powered submarines. Kilos might be able to remain underwater for a few days when lying in wait or operating at low speeds, or for as little as 1 to 3 hours when operating at high speeds. (High-speed operations drain the boat's batteries very quickly.) When traveling longer distances at moderate speeds, diesel-electric boats must snorkel periodically, making them vulnerable to detection and tracking when they are transiting to or from operating areas that are more than a couple of hundred miles from home port. A nuclear-powered submarine, in contrast, has tremendous submerged endurance at any speed – a U.S. SSN's submerged endurance is effectively limited only by the amount of food that can be carried aboard. If need be, a U.S. SSN can transit oceanic distances to an operating area, remain on station in that area for weeks or even months, and then return to home port – all without surfacing a single time.

Capability of Kilo Against Ships and Subs. The PLA Navy's Kilo-class submarines can launch attacks against surface ships and submarines operating in the region.

Torpedo Attack Against Surface Ships. China's Kilo-class boats reportedly carry two types of Russian-made, 53-centimeter (21-inch) diameter torpedoes. One is the Type 53-65 wake-homing torpedo, which is used for attacking surface ships. It has a speed of 45 knots, a range of 19 kilometers (about 10 nautical miles), and a 305-kilogram (670-pound) warhead. The other is the TEST-96 torpedo, which is used for attacking submarines. This torpedo is wire-guided and uses both active and passive sonar homing. It has a speed of 40 knots and a range of 15 kilometers (about

8 nautical miles), or alternatively a speed of 25 knots and a range of 20 kilometers (about 11 nautical miles). It carries a 205-kilogram (450-pound) warhead.[226]

In recent years, Western diesel-electric submarines posing as adversary submarines in NATO naval exercises reportedly have been able on at least some occasions to penetrate the ASW defenses of U.S. aircraft carrier battle groups and conduct mock attacks before being counterattacked.[227] Some observers, moreover, have expressed concern in recent years about what they view as a deterioration in the U.S. Navy's ASW capabilities and proficiency.[228] In light of these considerations, it appears plausible that U.S. naval forces might have difficulty under some circumstances detecting and tracking a well-maintained, proficiently operated Kilo-class submarine, particularly if the Kilo is stationary or operating at low speed, or if acoustic conditions degrade the performance of U.S. sonars.

In a combat situation, if the Kilo approaches close enough to a U.S. Navy surface ship (or vice versa) without being detected and attacked by U.S. naval forces, it could fire one or more torpedoes at the U.S. ship. This would pose a serious situation for the U.S. Navy ship: Surface-ship torpedo defense has been a concern in the U.S. Navy for several years, and while the Navy is working to improve its

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[226] The TEST-96 is also reported to have wake-homing guidance and an ability to be used against surface ships.

[227] One recent press report, for example, states that one of Australia's Collins-class boats "penetrated a screen of US surface ships to be in a position to sink a US aircraft carrier in [an] exercise off Hawaii." (Lague, David. 'Dud' Subs Fleet Impresses US. Sydney Morning Herald, July 27, 2000.) Another article states:

> In October [1997], a Russian Oscar-class nuclear-powered submarine left its home port at Vladivostok and prowled the Pacific Ocean, shadowing the USS Coronado, flagship of the U.S. Third Fleet, for several days. The U.S. Navy never knew it was there.... A year earlier, a Chilean diesel sub penetrated the perimeter of a U.S. Navy battle group and moved among its ship for several days. U.S. forces knew the sub, participating in an exercise with the Navy, would operate in an attack mode. Yet the Pacific Fleet Could not find it. The Chilean sub demonstrated that it could have targeted and fired on U.S. navy ships at any time. In exercises over several years, the U.S. Navy's most advanced antisubmarine warfare (ASW) ships have been unable to detect the South African Navy's Daphne[-class diesel-electric] subs, which were built 30 years ago. (Holzer, Robert. Dangerous Waters: Submarines, New Mines Imperil Ill-Prepared U.S. Navy Fleet. *Defense News*, May 4-10, 1998: 1, 14-15.)

[228] See, for example, Gildea, Kerry, "Pacific Naval Officials See ASW Shortage As Growing Problem," *Defense Daily*, July 20, 2000: 4; Skibitski, Peter J., "Navy Official Warns 'tenuous' ASW Road Map Is Underfunded," *Inside the Navy*, April 24, 2000; Holzer, Robert, "U.S. Navy To Review Antisubmarine Warfare Ability," *Defense News*, August 23, 1999: 10; Abel, David, "Navy Seeks To Shore Up Flagging Anti-Sub Warfare," *Defense Week*, June 21, 1999: 2; Donnelly, John, "An Asymmetric Threat 'Below The Layer'," *Sea Power*, July 1999: 42-46; Doney, Art, "Bring Back ASW – Now!," *U.S. Naval Institute Proceedings*, March 1999: 102-104. See also General Accounting Office. *Defense Acquisitions: Evaluation of navy's Anti-Submarine Warfare Assessment*. Washington, 1999. 14 p. (July 1999, GAO/NSIAD-99-85).

capabilities in this area, particularly in terms of deploying new sonar systems for rapidly detecting incoming torpedoes, the Navy does not currently have a surface-ship counter-torpedo weapon (i.e., an active-defense or "hard-kill" weapon) for destroying an incoming torpedo.[229] U.S. Navy ships instead would rely entirely on passive-defense techniques for diverting (i.e., achieving a "soft-kill" on) an incoming torpedo. These include evasive maneuvering or the use of a towed acoustic (i.e., noise-emitting) decoy such as the SLQ-25 NIXIE system.

An attack by a wake-homing torpedo would pose a particular threat to a U.S. navy ship, for two reasons. First, "the torpedoes are difficult to detect because they approach the ship from the rear where their sound is masked by the noise of the ship's propellers."[230] Second, a wake-homing torpedo would not be fooled by a towed acoustic decoy, and the ship might find it difficult to maneuver quickly enough to reduce or eliminate its wake.

Given these considerations, U.S. Navy officials might not be able to guarantee 100 percent effectiveness in defeating an incoming torpedo. Some analysts, in fact, might argue that the chance of defeating a torpedo attack would be considerably less than 100 percent.

If a 21-inch diameter torpedo detonated against or under the hull of a U.S. Navy surface combatant, the results could be devastating. At a minimum, the ship would be seriously or severely damaged and could lose much if not most or all of its combat potential. At a maximum, the keel of the ship could break and the ship would sink quickly. If the target were a larger ship such as an amphibious ship or an underway replenishment (resupply) ship, the larger size of the ship might permit the ship to withstand the attack somewhat better, but the damage to the ship would still be significant, and the ship's ability to continue performing its mission might still be compromised. If the target ship were an aircraft carrier – an even larger ship with a high degree of compartmentalization and perhaps a multiple-bottom hull designed to provide protection against torpedo attack[231] – the ship might have some ability to withstand a torpedo detonation, though its ability to maintain flight operations would by no means be guaranteed. Detonations from more than one torpedo, however,

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[229] For discussions of U.S. and Western torpedo-defense programs and torpedo-defense in general, see Skibitski, Peter J., "Navy Believes Big-Deck Ships Can Defend Against Torpedoes," *Inside the Navy*, April 10, 2000; Seigle, Greg, "Improved Torpedo Defense Detection For Key USN Destroyers and Cruisers," *Jane's Defence Weekly*, December 9, 199: 8; Vogel, Uwe, "Torpedo Defense – An Overview," *Naval Forces*, No. 4, 1999: 70-72, 74-75; Marvin, Ernest A. III, "Protecting The Surface Fleet From Torpedo Attack," *Naval Forces*, No. 3, 1999: 80-82 (Special Issue 1999, Naval Undersea Warfare Center, p. 36-38); Scott, Richard, "Seven Up For UK navy's Torpedo Defence System," *Jane's Defence Weekly*, August 11, 1999: 10.

[230] Smith, Craig S., "New Chinese Guided-Missile Ship Heightens Tension," *New York Times*, February 9, 2000.

[231] U.S. Navy battleships were known to have multiple-bottom hulls for protection against torpedo attack; it is thus possible that the Navy's even larger and more valuable aircraft carriers have similar hulls.

could well reduce or eliminate the carrier's ability to support flight operations, or possibly even threaten the survival of the ship itself.

Torpedo Attack Against Submarines. Reported incidents in 1992[232] and 1993[233] in which U.S. attack submarines have collided with more modern Russian nuclear-powered submarines suggest that U.S. submarines have sometimes had difficulty maintaining constant or accurate tracks on quiet Russian-made submarines. Western diesel-electric submarines posing as adversaries in U.S. naval exercises have also reportedly been successful in conducting mock attacks on U.S. Navy attack submarines.[234] These incidents suggest that U.S. attack submarines, like U.S. surface ships, could have difficulty under some circumstances detecting and tracking a well-maintained, proficiently operated Kilo-class submarine, particularly if the Kilo is stationary or operating at low speed, or if acoustic conditions degrade the performance of U.S. sonars.

In a combat situation, if the Kilo approaches close enough to a U.S. Navy attack submarine (or perhaps more likely, vice versa) before the Kilo is detected and attacked by U.S. naval forces, it could fire one or more torpedoes at the U.S. submarine. This would again pose a serious situation for the U.S. attack submarine: The Navy does not currently have a submarine counter-torpedo weapon for destroying an incoming torpedo. U.S. submarines would instead would rely on evasive maneuvering and the use of expendable acoustic decoys ejected from the ship.

As with surface ships, U.S. Navy officials might not be able to guarantee 100 percent effectiveness in defeating a torpedo approaching a U.S. attack submarine, and the effect on a U.S. Navy submarine of a hit from a 21-inch torpedo could be devastating. Soviet-designed nuclear-powered attack submarines are designed with

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[232] In February 1992, the Baton Rouge, a Los Angeles (SSN-688) class attack submarine, collided with a Russian submarine (by one account a Sierra-class attack submarine) in the Barents Sea. Lancaster, John. U.S., Russian Subs Collide in Arctic. *Washington Post*, February 19, 1992: A1, A24; Evans, David. Insider to Probe Sub Collision. *Chicago Tribune*, February 20, 1992: 6; Offley, Ed. Navy to Investigate Only the Cause of Sub Collision. *Seattle Post-Intelligencer*, February 24, 1992: 1; Gertz, Bill. Russian Sub's Sail Damaged in Collision. *Washington Times*, February 27, 1992: 4; Steigman, David S. Subs Slam at Periscope Depth. *Navy Times*, march 2, 1992: 12; Miasnikov, Eugene. Submarine Collision off Murmansk: A Look from Afar. *Breakthroughs*, Winter 1992/93: 19-24.

[233] In March 1993, the Grayling, a Sturgeon (SSN-637) class attack submarine, collided with a Russian Delta III-class ballistic missile submarine in the Barents Sea. Gellman, Barton. U.S. and Russian Nuclear Subs Collide. *Washington Post*, March 23, 1993: A12; Gordon, Michael. U.S. and Russian Submarines Collide in the Arctic. *New York Times*, March 23, 1993: A12; Gertz, Bill. Clinton Apologizes for Sub Collision. *Washington Times*, April 5, 1993: 8; U.S. Reviews Strategy of Trailing Russian Subs Following Collision. *Inside the Pentagon*, April 15, 1993: 12-13; Matthews, William. Sub vs. Sub. *Navy Times*, May 24, 1993: 12-13; Aspin Discloses 'Major Changes' by US to Avoid Sub Collisions. Associated Press wire service report, June 6, 1993.

[234] The report about one of Australia's Collins-class boats penetrating a screen of US surface ships in an exercise off Hawaii also stated that in an earlier exercise, the Collins-class boat "was able to stalk and 'kill' US Los Angeles-class nuclear attack submarines." (Lague, David. 'Dud' Subs Fleet Impresses US. Sydney Morning Herald, July 27, 2000.)

multiple features intended to give them some ability to withstand a hit from an enemy torpedo. These include double hulls (i.e., a second, outer hull separated by a few or several feet from the inner pressure hull), a large amount of reserve buoyancy, and multiple watertight compartments.[235] U.S. submarines, in contrast, are single-hulled and have much less reserve buoyancy and possibly fewer watertight compartments.

Cruise Missile Attack Against Surface Ships. China's four Kilo-class boats reportedly are not equipped with anti-ship cruise missiles. *Jane's Fighting Ships*, however, states that if China orders any additional Kilos, these boats might possibly come equipped with the SS-N-27 Novator Alpha ASCM. Another source cites reports that China may be acquiring SS-N-27s for its current Kilos.[236] A recent press report states that China is negotiating to purchase the 3M54 ASCM for its Kilos;[237] this missile is either the SS-N-27 or a closely related missile.

A Kilo armed with SS-N-27s could pose a more serious threat to U.S. surface ships than China's SS-N-22-armed Sovremenny-class destroyers, for two reasons. First, and perhaps most important, the Kilos could be more difficult to detect, track, and attack than a Sovremenny-class ship. They might thus be more likely to succeed in firing one or more missiles at U.S. Navy ships than a Sovremenny-class destroyer.

Second, the SS-N-27 is considered at least as capable as the SS-N-22. The SS-N-27 is thought to be a derivative of the subsonic Soviet/Russian SS-N-21 land attack cruise missile (the Soviet analogue to Tomahawk). It has a range of possibly 200 kilometers (about 108 miles) and cruises to the target area at subsonic speeds (making it potentially less visible to infrared sensors than the SS-N-22). A special warhead stage then separates from the missile and uses a rocket booster to fly to the target at a speed of more than Mach 2 and at an altitude of only 5 to 7 meters (as opposed to 7 to 20 meters for the SS-N-22). The warhead reportedly weighs 200 kilograms (440 pounds).

The ability of a Kilo-class ship to use the SS-N-27 effectively, however, would depend on China's over-the-horizon targeting ability, its ability to transmit over-the-horizon targeting information to Kilo-class ships, and the ability of the Kilo to receive this information without being detected. As noted in an earlier-cited passage, China's over-the-horizon targeting capability is limited. Its ability to transmit this information in a timely manner to Kilo-class boats may be similarly or even more limited, and receiving the information could make the Kilo vulnerable to detection.

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[235] These features appear to have reflected a judgment by Soviet officials that in a U.S.-Soviet submarine engagement, the U.S. submarine, with its superior quieting and combat system, would likely be able to fire at the Soviet submarine before the Soviet submarine could fire back, and that the Soviet submarine would therefore need to be able to withstand a hit from a U.S. torpedo.

[236] Zaloga, Steven. *World Missiles Briefing*. Fairfax (VA), Teal Group Corporation, 2000. (Regularly updated.) Entry on Russian Anti-Ship Missiles (February 2000), p. 6.

[237] Zhang, Yihong. China Negotiates To Buy Advanced Russian Anti-Ship Missile. *Jane's Defence Weekly*, August 9, 2000.

Vulnerability of Kilo-class Design to Attack. As discussed above, U.S. forces might have difficulty under some circumstances in detecting and tracking a well-maintained, proficiently operated Kilo-class submarine, particularly if the Kilo is stationary or operating a low speed, or if acoustic conditions degrade the performance of U.S. sonars. U.S. ASW forces might have to commit significant ASW assets and conduct a sustained ASW effort to detect and maintain a reliable track on such a Kilo. If U.S. ASW proficiency at the time were degraded due to reduced ASW training, the difficulty of the task would be compounded.

Kilo-class boats are nevertheless vulnerable to detection and attack by U.S. forces. As a diesel-electric submarine, the Kilo-class design has limited submerged mobility, and U.S. ASW forces could exploit this limitation. (A classic strategy is to wait in the general area where the submarine is believed to be, until the submarine is forced to surface.) Kilo-class submarines would be particularly vulnerable to detection and attack when leaving port, transiting to more distant operating areas (which would require periodic use of their snorkels), or after firing any of their weapons (which creates significant noise). They would also be vulnerable if they are operated in ways that compromise their stealth. This could include using a periscope or data-receiving antenna or traveling quickly at a shallow depth, which can induce propeller cavitation (a significant source of noise). Although U.S. and Western naval officials express concern about Kilo-class submarines, they also appear confident in their ability to eventually detect and attack it.

Although the Kilo, as discussed earlier, has some built-in features for surviving a hit from a torpedo attack, a hit from a single torpedo might still compromise its combat capability. Even if the Kilo is still capable of fighting after that hit, the damage to the ship could well increase the ship's vulnerability to follow-on attack. Hits from additional torpedoes would then more certainly eliminate the ship's combat capability or sink it entirely.

U.S. naval forces have had many years to study the Kilo-class design, particularly since it is operated not only by Russia, but by countries in regions of the world where forward-deployed U.S. naval forces regularly operate. As a consequence, the U.S. Navy probably has developed an extensive understanding of the design's capabilities, as well as tactics for detecting, tracking, and attacking it. U.S. weapons that could be used against Kilo-class submarines include the submarine-launched Mk 48 heavyweight (21-inch diameter) torpedo or surface- or air-launched Mk 46, Mk 50, or Mk 54 lightweight (12.75-inch diameter) torpedoes.

Potential Tactical Implications. If China can maintain its Kilos in good condition and operate them proficiently, then the threat that these boats might pose to U.S. naval forces in a crisis or conflict would (like the case with the Sovremenny-class destroyers) appear to depend on the scenario in which the Kilos engaged U.S. forces.

If, at the outset of a crisis involving China, the United States already knows locations of China's Kilo-class boats – perhaps through day-to-day use of satellite observation of the Kilos while in port, or covert tracking by U.S. submarines of the Kilos while at sea – U.S. naval forces could take many of the kinds of preparatory actions discussed earlier in relation to engaging Sovremenny-class ships. This could

significantly reduce the threat to U.S. naval forces posed by the Kilos: At the outbreak of hostilities, a rapid attack by U.S. ASW forces could lead to the disabling or destruction of the boats before they could fire many (or any) of their torpedoes (or cruise missiles) while maximizing the chances of defeating any that are launched.

If, on the other hand, the United States at the outset of a crisis does not know the location of one or more of the Kilos, or is not able to maintain a reliable track on them, then the threat posed by the Kilos to U.S. naval forces would likely be greater. U.S. naval forces might need to approach potential Kilo operating areas more cautiously, or perhaps even temporarily avoid them. They might also need to increase the scale and intensity of their ASW operations. Ships might need to position themselves to optimize their contribution to the fleet's collective ASW effort, which could reduce their ability to perform other missions. As a result, the time needed for U.S. naval forces to enter and establish control over certain sea areas could increase by hours, and perhaps by as much as several days. This delay could significantly affect subsequent course of the conflict, particularly if it permits Chinese military forces to complete other key tasks in the opening phases of their military plan.

Alternatively, in the absence of a crisis or regional tension, China could use a Kilo-class ship to conduct a no-warning attack on U.S. naval forces operating near China, perhaps for the kind of political purposes discussed earlier in relation to the scenario of a no-warning SS-N-22 attack. Such an attack would pose a grave danger to a U.S. ship that was not on ASW alert, and (if a wake-homing torpedo is used) a still-significant danger to a U.S. ship that was on ASW alert. In the case of an unalerted U.S. ship, the attack could, barring a torpedo malfunction, have a high chance of success.

Following the attack, China could claim that it was an accident or a case of mistaken identity – or even disavow responsibility for it, as Iran did in the case of mine attacks on some ships in the Persian Gulf during the Iran-Iraq war. Circumstances might point strongly to China as the responsible party, but China could point out that it is not the only country that operates submarines in the Western Pacific,[238] or argue (in defiance of any evidence to the contrary) that the U.S. ship was damaged by one or more internal explosions (the explanation which the United States told Russia it believes to be the most likely for the August 2000 sinking of the Russian Oscar-class submarine Kursk) or that it was hit by an errant mine (one of the alternative explanations advanced by Russian officials for the sinking of the Kursk).

Although much attention has been paid in the press to China's purchase of Sovremenny-class ships armed with SS-N-22s, the Kilos, with their potential for avoiding detection and their potent torpedoes, might represent a greater threat to U.S. naval forces, particularly in light of the U.S. Navy's current torpedo-defense capabilities. The threat posed by Kilos could become even greater if they are armed with the SS-N-27 cruise missile and China improves its over-the-horizon targeting capabilities. This would permit the Kilos to launch attacks at much greater distances,

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[238] Eight of Russia's 12 Kilos are based in the Pacific at Rakovaya. Several of Russia's nuclear-powered attack submarines are also based in the Pacific.

increasing their likelihood of being able to launch their weapons before they are attacked or even detected by U.S. forces.

China's Kilo-class submarines are by no means invulnerable. Their limited mobility can be used against them, and problems in maintaining the ships properly or operating them proficiently could easily increase their chances of being detected and tracked. However, there are the potential difficulty of detecting and tracking a well-maintained, proficiently-operated Kilo as well as the grave danger that a torpedo attack would pose to an unalerted U.S. ship. Hence, one option for the United States would be to adopt a policy – if China shows evidence of being able to maintain the ships properly and operate them proficiently – of attempting to maintain knowledge of the location of the Kilos at all times, and of putting all U.S. Navy ships deployed to potential Kilo operating areas on ASW alert when any of the Kilos are not known to be in port and their location at sea is not known. Such a policy, or something like it, may already be in effect.

Integrated Operations[239]

Although previous sections of the report assessed China's air power acquisitions and naval acquisitions separately, the operational significance of China's conventional arms acquisitions will also depend in part on the PLA's ability to conduct effective joint military operations that integrate its air force and navy, as well as missile and other assets. The PLA's ability to achieve jointness and integration might be particularly significant in examining potential crisis or conflict scenarios situated in the Taiwan Strait or the South China Sea, where China might be expected to employ land-based aircraft, navy, and other assets.

In such scenarios, operating air and naval assets as a single, integrated force could permit land-based aircraft to provide over-the-horizon targeting data for missile-armed PLAN ships or help defend such ships against attack by opposing aircraft. Conversely, PLAN ships deployed some distance from shore could provide early warning of opposing aircraft flying toward China, which could help China's land-based air defense systems in countering those aircraft. Effective integration of aircraft and ship ASW operations could also improve China's efforts to detect and counter opposing submarines.

As noted earlier, PLA military exercises to date have displayed little integration between air force and naval (as well as missile and army) forces. As also noted earlier, however, the complexity and scope of PLA military exercises have steadily increased, and PLA leaders understand the potential warfighting benefits of operating forces in a joint, integrated manner. As a result, China might be expected to incorporate the concept of joint and integrated operations increasingly into its exercises and may achieve some proficiency in such operations in coming years.

Achieving jointness and integration is more important to some kinds of military operations than others. For some military operations, such as amphibious assault and

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[239] Prepared by Ronald O'Rourke and Christopher Bolkcom.

close-air support operations, jointness and integration can be critical to success. A lack of integration between air and other units in such operations could easily prove disastrous.

For other military operations, such as air defense or local ASW operations, achieving integration between air and surface units might not be essential but could still significantly improve effectiveness. In these cases, a lack of integration could reduce the efficiency of China's military efforts but would not prevent PLA forces from achieving some degree of effectiveness.

For still other military operations, achieving jointness and integration might be relatively unimportant. These include ballistic missile attacks, air intercept and strike operations by land-based aircraft, attacks on surface ships by either ships or land-based aircraft (if the attacking platforms can locate the target ships without outside assistance), offensive mining operations (provided that friendly ships are informed to stay away from the areas to be mined), and submarine operations (which traditionally have often been carried out in isolation from other military forces). In these cases, a lack of jointness or integration might not significantly effect operational effectiveness.

Potential PLA operations of concern to other Asian and U.S. military planners fall into all three of these categories. A full-scale PLA attack on, and invasion of, Taiwan, for example, could require considerable jointness and integration to have some chance of success. Other potential military operations of concern – such as a large-scale ballistic missile attack intended to neutralize Taiwan's defense systems and intimidate Taiwan generally, or an offensive mining operation intended to intimidate commercial shipping in the area – might require little or no jointness and integration to have a reasonable chance of success. Thus, the importance of China's ability to achieve joint and integrated military operations as a factor to consider in assessing China's conventional arms acquisitions could depend on the scenario in question and the kinds of specific, potential PLA operations associated with it.

In summary, China has made some significant qualitative upgrades through foreign arms acquisitions, but it remains to be seen how these acquisitions will be expanded and linked to other PLA improvements. The operational significance of China's conventional arms acquisitions will also depend on the PLA's training to eventually conduct effective joint military operations and the scenario in which the systems might be used. These developments in PLA modernization will bear watching.

Appendix: Acronyms and Abbreviations

AAM	Air-to-air missile
AEW	Airborne early warning
ASCM	Anti-ship cruise missile
ASW	Anti-submarine warfare
ATBM	Anti-tactical ballistic missile
AWACS	Airborne warning and control system
C^4I	Command, control, communications, computers, and intelligence
CAP	Combat air patrol
COMINT	Communications intelligence
CVBG	Carrier battle group
ECM	Electronic countermeasures
ELINT	Electronics intelligence
EW	Electronic warfare
IFF	Identification friend or foe
IOC	Initial operational capability
IR	Infra red
kg	Kilogram
km	Kilometer
kt	Kiloton
lb	Pounds
mi	Miles
mph	Miles per hour
NATO	North Atlantic Treaty Organization
nm	Nautical miles
PLA	People's Liberation Army
PLAAF	People's Liberation Army Air Force
PLAN	People's Liberation Army Navy
PRC	People's Republic of China
ROE	Rules of engagement
SAM	Surface-to-air missile
SAR	Semi-active radar
SS	Diesel-electric submarine
SSBN	Nuclear-powered ballistic missile submarine
SSN	Nuclear-powered attack submarine
SEAD	Suppression of enemy air defenses
TBM	Tactical ballistic missile
TEL	Transporter-erector-launcher
UAV	Unmanned aerial vehicle
UN	United Nations
WX	Weather