

Conventional War across the Taiwan Strait

by Felix K. Chang

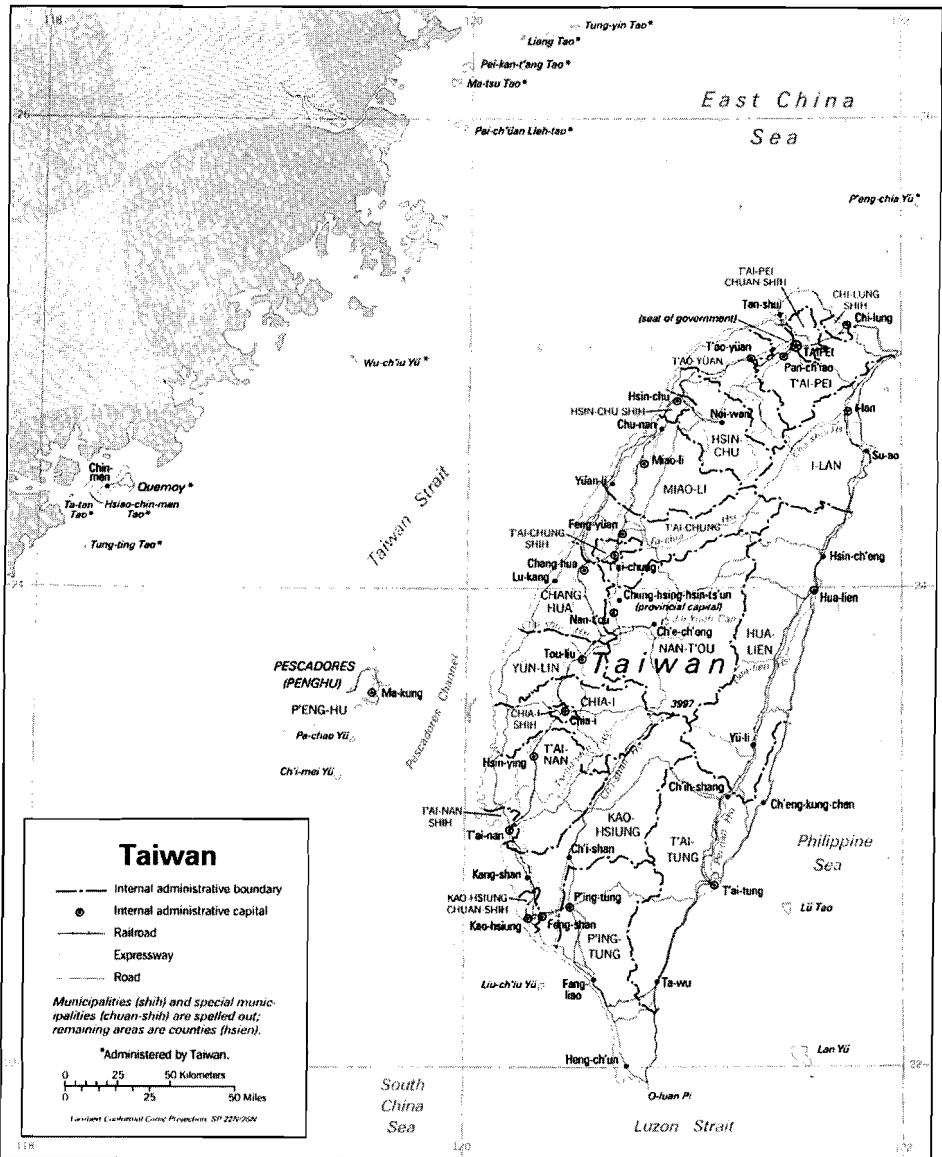
The Nationalist government in Taiwan has been a constant and visible challenge to the Beijing regime's claim to be the legitimate government of all China since the inception of the People's Republic in 1949. Accordingly, Beijing's political objective has been to compel Taipei to accede to reunification on its terms. To be sure, other more pressing political goals absorbed China's attention during the cold war, but since the late 1980s the growing independence movement on Taiwan coupled with the collapse of the Soviet Union has returned the Taiwanese issue to a prominent place among China's strategic concerns. Chinese leaders in Beijing, now assiduously cultivating Chinese nationalism as a force for internal political stability, could not ignore this mounting challenge to their authority and to the integrity of China. In 1992, a Chinese official with "ties to senior generals" stated, "If Taiwan declares independence, we'll have to attack them."¹ More recently, Beijing held a series of missile tests and military maneuvers near Taiwan between July 1995 and March 1996 to demonstrate its resolve.²

¹ Chinese official quoted in Nicholas D. Kristof, "As China Looks at World Order, It Detects New Struggles Emerging," *New York Times*, Apr. 21, 1992. On Chinese nationalism in Taiwan, see Patrick E. Tyler, "China's Campus Model for the 90s: Earnest Patriot," *New York Times*, Apr. 23, 1996; Matt Fomey, "Louder Than Words," *Far Eastern Economic Review*, Mar. 14, 1996, pp. 14-15; V.G. Kulkarni and Julian Baum, "Biting the Ballot," *Far Eastern Economic Review*, Mar. 14, 1996, pp. 18-19; Hung-mao Tien, "Taiwan in 1995: Electoral Politics and Cross-Strait Relations," *Asian Security*, Jan. 1996, pp. 33-40; Patrick E. Tyler, "On the Farms, China Could Be Sowing Disaster," *New York Times*, Apr. 10, 1995; Bonnie S. Glaser, "China's Security Perceptions," *Asian Security*, Mar. 1993, pp. 252-71; Parris H. Chang, "Beijing's Relations with Taiwan," in *If China Crosses the Taiwan Strait: The International Response*, ed. Parris H. Chang and Martin L. Lasater (Lanham, Md.: University Press of America, 1993), pp. 1-13; and Susan L. Shirk, "The Chinese Political System and the Political Strategy of Economic Reform," and Jonathan D. Pollack, "Structure and Process in the Chinese Military System," in *Bureaucracy, Politics, and Decision Making in Post-Mao China*, ed. Kenneth G. Lieberthal and David M. Lampton (Berkeley: University of California Press, 1992), pp. 59-91, 151-80.

² On Chinese military maneuvers and the Taiwanese election, see Patrick E. Tyler, "China Says Maneuvers Will Last Through Taiwan's Elections," *New York Times*, Mar. 16, 1996; Patrick E. Tyler, "War Games Off Taiwan To Expand, Beijing Says," *New York Times*, Mar. 10, 1996; Edward A. Gargan, "Chinese, In a Move To Alarm Taiwan, Fire Test Missiles," *New York Times*, Mar. 8, 1996; Patrick E. Tyler, "Sound and Fury in East Asia," *New York Times*, Aug. 23, 1995; Patrick E. Tyler, "China Said to Seek to Rein in Taiwan With War Games," *New York Times*, Aug. 19, 1995; and "China Goes Ballistic," *The Economist*, July 29, 1995, p. 23.

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Map 1 Taiwan Strait



Source: Central Intelligence Agency, Washington, D.C.

In conjunction with this renewed bellicosity toward Taiwan, China's effort to accelerate its conventional force modernization has occasioned some observers to speak of a "China threat," despite Beijing's emphatic statements that a "so-called 'China threat' is groundless and absurd."³ Nonetheless, China's

³ Embassy of the People's Republic of China, *Newsletter* (Washington, D.C., June 21, 1993), p. 1.

current defense strategy has been designed “to accelerate the modernization of [its] war potential and its capacity to mobilize from peacetime to wartime in emergencies.”⁴ One such emergency, of course, may be the forcible reunification of Taiwan. However, this prospect poses a dilemma for Chinese leaders in Beijing. They must ensure a politically meaningful victory or else they will have leveraged most of their domestic and international standing for little or no gain. But if they use too much force to ensure that victory, they may trigger U.S. intervention:

To balance the need for force sufficient to bend Taipei's will but low enough to avoid, if at all possible, a direct military conflict with the United States, China's political and military planners would be required to develop a military campaign that avoids any semblance of bluff. . . . This military coercion . . . must be viewed as very precisely directed at Taiwan and devised to avoid a wider war.⁵

To paraphrase Paul Godwin, China's first military objective would be to close Taiwan's ports; the second would be so to damage Taiwan's logistical support base and morale that its military could not resist an invasion; the third would be to invade Taiwan itself.⁶ Thus, China requires more than the ability to cross the Taiwan Strait with a strong invasion force—it needs to achieve sufficient air and sea control in the theater to define the parameters of the battlefield and close all avenues of external support to Taiwan. Logically, one of the Chinese navy's four principal missions is “to conduct a possible blockade of Taiwan.”⁷ Conversely, the Taiwanese government must attempt to break whatever blockade Beijing erects to gain not only needed supplies but also political capital and international support. (See Map 1.)

Correlation of Ground Forces

Some commentators continue to assert that, as a result of the correlation of forces involved, it would not be difficult for the People's Liberation Army (PLA) to force an amphibious crossing of the Taiwan Strait and decisively defeat Taiwanese ground forces. But one should recall that in October 1949

five battalions of the PLA's 61st Division began an assault on the Nationalist-held Dengbu Island. But even with their crushing superiority, the PLA units could not prevent the introduction of enemy reinforcements by sea, and after suffering 1,490 casualties,

⁴ John Wilson Lewis and Xue Litai, *China's Strategic Seapower: The Politics of Force Modernization in the Nuclear Age* (Stanford, Calif.: Stanford University Press, 1994), pp. 218–19. See also “Experts View Deng's Thoughts on Army Building,” Foreign Broadcast Information Service, *Daily Report: China* (hereafter FBIS, *China*), Sept. 1, 1993, p. 25, from *Jiefangjun Bao*, Aug. 22, 1993; “Article Views ‘In-Depth’ Reform of Army,” FBIS, *China*, Aug. 27, 1992, pp. 32–35, from *Jiefangjun Bao*, July 31, 1992.

⁵ Paul H.B. Godwin, “Use of Military Force Against Taiwan,” in *If China Crosses the Taiwan Strait*, ed. Chang and Lasater, pp. 16–17. See also Paul H.B. Godwin, “Chinese Military Strategy Revised: Local and Limited War,” *Annals*, Jan. 1992, pp. 191–201; Martin L. Lasater, *Beijing's Blockade Threat to Taiwan*, Heritage Lectures, no. 80 (Washington, D.C.: Heritage Foundation, 1985).

⁶ Godwin, “Use of Military Force Against Taiwan,” p. 18.

⁷ Lewis and Xue, *China's Strategic Seapower*, p. 226.

the Communist troops retreated in defeat. Later that same month, the PLA Tenth Army attacked the island of Quemoy, and again lost the battle at sea. It could not reinforce the initial invasion force. Taking more than 9,000 casualties, the stranded force perished, and ever after its defeat for lack of sea and air support constituted an oft-repeated "bloody lesson."⁸

What is China's current amphibious capability? One assessment posited that only 6,000 troops could be transported across the strait.⁹ A more recent evaluation contended that China's "available sealift could transport the soldiers of one Chinese division" (which appears reasonable in light of the PLA Navy's [PLAN] amphibious forces).¹⁰ It is nevertheless instructive to note that Chinese commanders supplemented their military amphibious craft with fishing boats during their March 1996 military maneuvers off Fujian. However, even if the PLA could transport two or three divisions, it would still have difficulty finding suitable invasion beaches on Taiwan's western coast.¹¹ In any case, Taiwanese intelligence would certainly detect such a large project, since the mere assemblage of forces by the PLA 12th, 1st, 31st, and 42nd Group Armies in the Jiangsu, Zhejiang, Fujian, and Guangdong military districts would entail a conspicuous fabrication of landing craft, a dramatic increase in radio traffic, and construction of temporary housing. (A number of soldiers on Pingtan Island, the main staging area for Chinese maneuvers in March 1996, were reported to have died owing to a deficiency in adequate shelter, and the morale of the PLA front-line units suffered correspondingly.¹²) Although Chinese signals deception could be employed to mislead Taiwanese forces as to the location of the real assault, the fact that an invasion was imminent could not be easily concealed.

Even if initially deceived, the Taiwanese army could still mount determined resistance by using its interior rail and road networks to shift ground forces rapidly to the landing sites, while Chinese heavy equipment was still being ferried across the strait. Taiwan's forty-two AH-1W attack helicopters could also be swiftly brought to bear against Chinese assault troops and armor. Each AH-1W can mount up to eight BGM-71 TOW or AGM-114 Hellfire antitank missiles in addition to its standard M197 20 mm Gatling gun. The delivery of three hundred M-60A3 main battle tanks in May 1996, augmenting the twenty M-60 tanks transferred last year, will certainly help to strengthen Taiwan's mobile reserves. Also, Taipei is seriously considering the purchase of a further fifty-six

⁸ Ibid., p. 219.

⁹ Harvey Feldman, "The Likely International Response," in *If China Crosses the Taiwan Strait*, ed. Chang and Lasater, p. 71.

¹⁰ Thomas Hirschfeld, "The Year of the Rat," U.S. Naval Institute *Proceedings* (hereafter *Proceedings*), May 1996, p. 58.

¹¹ Ibid., p. 59.

¹² "Cannon Fodder," *Far Eastern Economic Review*, Mar. 28, 1996, p. 12; "China in Transition," *Far Eastern Economic Review*, Apr. 4, 1996, p. 32.

Table 1
Comparison of Ground Forces, 1996

Equipment	China	Taiwan
Personnel	2,200,000	240,000
Main battle tanks	7,500–8,000	870+
Light tanks	1,200	905
Armored fighting vehicles/ Armored personnel carriers	4,500	225/950
Towed artillery	14,500	1,060
Multiple rocket launchers	3,800	Some
Self-propelled artillery	Some	315

Sources: International Institute for Strategic Studies, *The Military Balance 1995/96* (Oxford: Oxford University Press, 1995), pp. 176–79, 192–93; author's estimates.

155 mm howitzers along with forty-four targeting radars from France.¹³ (See Table 1.)

To be sure, Chinese commanders could use the PLA 15th Airborne Army's three brigades or divisions, totaling some 10,000 officers and men, to spearhead their assault. But despite its recent purchase of ten to fifteen Il-76 transports, China would still have to rely on its inadequate fleet of Y-8, Y-7, and Y-5 transports to lift most of its airborne units.¹⁴ Above all, the PLA Air Force (PLAAF) and PLA Naval Air Force (PLANAF) would need to ensure at least temporary air supremacy over the Taiwan Strait during the airlift or else China's paratroopers might be destroyed even before they reached the ground.

¹³ See "Taiwan Is Said to Buy 300 More U.S. Tanks," *New York Times*, Apr. 15, 1996; "Taiwan to Boost Its Artillery, Claim Reports," *Jane's Defence Weekly*, Apr. 10, 1996, p. 18; Timothy M. Laur and Steven L. Llanso, *Encyclopedia of Modern U.S. Military Weapons* (New York: Berkeley Publishing Group, 1995), pp. 110–12, 160–62, 267–72; and International Institute for Strategic Studies (IISS), *The Military Balance 1995/96* (Oxford: Oxford University Press, 1995), pp. 171, 192.

¹⁴ IISS counts these airborne units as divisions rather than brigades and reports that fifteen Il-76 transports were purchased from Uzbekistan. Authors Kenneth Allen, Glenn Krumel, and Jonathan Pollack, as well as the U.S. General Accounting Office, report that China has only ten Il-76 transports. John Caldwell and *Jane's Defence Weekly* believe that the 15th Airborne Army's brigades are being expanded into divisions. See IISS, *The Military Balance 1995/96*, pp. 171, 177, 192; Kenneth W. Allen, Glenn Krumel, and Jonathan D. Pollack, *China's Air Force Enters the 21st Century* (Santa Monica, Calif.: RAND, 1995), pp. 168–70, 197–98; U.S. General Accounting Office, *Impact of China's Military Modernization in the Pacific Region* (Washington, D.C.: U.S. General Accounting Office, June 1995), p. 23; John Caldwell, *China's Conventional Military Capabilities, 1994–2004: An Assessment* (Washington, D.C.: Center for Strategic and International Studies, 1994), p. 5; and "PLA Airborne Brigades Become Divisions," *Jane's Defence Weekly*, Oct. 2, 1993, p. 13.

Table 2
Comparison of Air Forces, 1996

	Aircraft Designator	Inventory
<i>China</i>		
Fighter	J-5 (MiG-17F)	400+
	J-6 (MiG-19)	3,280
	J-7 (MiG-21)	555
	J-8	124–140+
	Su-27	26 (72)
Attack Bomber	Q-5	470–500+
	H-5	360–430+
ASW	H-6	134–145
	SA-321	9–15
	Z-5	10–40
	Z-8	3–5
	Z-9	10–50
<i>Taiwan</i>		
Fighter	F-104	50
	RF-104	6
	F-5B	7
	F-5E	215
	F-5F	53
	F-16A/B	40+ (150)
	Mirage 2000Ei/Di	30 (60)
Trainer/Attack	Ching-kuo	38 (130)
	AT-3A/B	59
AEW	E-2C/D	4 (8)
ASW	S-2T	31
	S-70C(M)1	19+
	SH-2F/G	12
	Hughes 500MD	11–12

Source: Table compiled by author from a variety of sources. Parentheses represent final numbers once total orders are completed.

Correlation of Air Forces

Offensive operations. The PLAAF and PLANAF do not face the problem of range in the Taiwan area of operations as they do in the South China Sea. However, they continue to suffer from deficiencies in aircraft maintenance, training, and number of advanced aircraft.¹⁵

As frequently outlined by Western observers as well as Chinese leaders in Beijing, China could mass its air forces in a combined effort to inundate and suppress Taiwan's air defenses and command, control, and communications

¹⁵ For a more detailed discussion of the problems faced by the PLAAF and PLANAF, see Felix K. Chang, "Beijing's Reach in the South China Sea," *Orbis*, Summer 1996, pp. 353–74.

(C³) centers. (See Table 2.) Because of the proximity of Chinese air bases, constructed in Fujian to support just such an operation, the PLAAF and PLANAF do have the potential to amass thousands of aircraft in a campaign to secure air supremacy over Taiwan, after which they could strike Taiwanese military installations, transportation networks, and food and fuel depots at will. But the mere potential for mass is not sufficient. Launched from several air bases at different times, the attacking aircraft would need to be carefully orchestrated in order to assemble the “mass in time” necessary to penetrate Taiwanese air defenses.¹⁶ Piecemeal attacks, by contrast, might not only fail to pierce Taiwan's defenses but also suffer potentially heavy losses. By way of comparison, during the Sino-Vietnamese conflict in 1979 the PLAAF's 700 aircraft and helicopters—despite enjoying air supremacy—made only 8,500 sorties over sixty-plus days of operations, whereas over the forty-three days of Operation Desert Storm coalition air forces made more than 112,000 sorties with 2,780 fixed-wing aircraft alone.¹⁷ Painfully aware of their shortcomings, Chinese commanders have diligently attempted to improve their C³ systems and develop an airborne early warning (AEW) capability. Accordingly, they have converted a Tu-4 bomber and possibly a Y-8 transport into preliminary platforms for such a role. However, China currently has no known operational AEW aircraft, despite a fleeting November 1993 BBC report that China may have installed British-built Nimrod radar systems on three of its ten to fifteen Il-76 transports to create A-50 AEW platforms.¹⁸

Moreover, China's front-line air bases do not possess the repair and maintenance facilities to provide for sustained air operations as a consequence of its *qian qing hou zhong* or “light front, heavy rear” strategy. As front-line units are rendered inoperable by combat or maintenance concerns, they would have to be replaced by follow-on units from rear areas. And since almost all Chinese-built fighter engines, such as the Chengdu WP7B (BM), Liyang WP13A II, and Klimov RD-93, “require a major overhaul after 300 to 350 hours [of flying time], a second overhaul after an additional 200 to 250 hours, and a third after an additional 150 hours,” many aircraft would be forced to return to rear areas for refit.¹⁹ This fact is not materially ameliorated by China's purchase of one

¹⁶ Mass refers to the concentration of combat power. Time incorporates the elements of duration, frequency, sequence, and opportunity, in terms of the human and technical ability to perceive and react. To achieve mass in time, a military force must integrate its mass with these elements of time in such a way as to produce a situation that cannot be understood, controlled, or responded to by an adversary.

¹⁷ See Allen, Krumel, and Pollack, *China's Air Force Enters the 21st Century*, pp. 92–93; U.S. Department of Defense, *Conduct of the Persian Gulf War* (Washington, D.C.: Government Printing Office, 1992), p. 164.

¹⁸ Bernard Blake, ed., *Jane's Radar and Electronic Warfare Systems* (hereafter *Jane's REWS*) 1995–96 (Surrey, England: Jane's Information Group Limited, 1995), p. 258. The British Broadcasting Corporation report stated that China may have purchased sixteen British-built Nimrod radar systems in 1990–91. See Allen, Krumel, and Pollack, *China's Air Force Enters the 21st Century*, p. 172.

¹⁹ Allen, Krumel, and Pollack, *China's Air Force Enters the 21st Century*, pp. 114–15, 198. See also Paul Jackson, Kenneth Munson, and John W.R. Taylor, eds., *Jane's All the World's Aircraft 1995–96* (Surrey, England: Jane's Information Group Limited, 1995), pp. 48–68, 697–99, 781–82.

hundred RD-33 engines that power the MiG-29 from Russia, since the engines are probably intended to upgrade Chinese J-7 fighters, which may be exported.²⁰

The Chinese air forces' principal adversary is Taiwan's national air defense system, the Taiwan Air Defense Ground Environment or Tien Wang (Sky Net). Controlled centrally from the Combat Air Command and Control Center at Kung Kuan, the system was established in 1980 and upgraded in 1989 through the Chang Wuang (Improved Net) program. The system is based on a fully automated backbone network of twenty air search radars with secure microwave communications that integrates surface-to-air missile (SAM) defenses and interceptor squadrons. The network includes two FPS-117 long-range air search radars, two HADR systems, and several smaller TPS-43 air search radars. Employed as the basis of the American-Canadian North Warning System, the very low maintenance FPS-117 phased-array radar integrates a distributed, redundant network of transceiver and power supplies, and can suppress heavy electronic countermeasures and environmental clutter. The Chang Wuang upgrade includes not only advanced automation but also a number of TPS-592 air search radars (the mobile variant of the FPS-117) and TPQ-36A low-altitude surveillance radars. Somewhat unsettling for Taiwan, early model TPQ-36 units serving in Thailand were found to be wanting, even though they served admirably with U.S. forces in the Persian Gulf.²¹

Furthermore, Taiwanese engineers developed the Tien Kung (Sky Bow) air defense system from "an 85 percent [technology] transfer . . . of the MIM-104 Patriot design."²² Targeting for the system is resolved through the interaction of a Chang Bai (Long White) phased-array radar and two MPG-25 illumination radars in a time-share basis, founded on a principle similar to that employed by the American SPY-1D Aegis. The Tien Kung 1 surface-to-air missile uses a Patriot launcher with indigenous electronics for low- to medium-altitude interception, while the Tien Kung 2 was designed for medium- to high-altitude interception. The Tien Kung 3, incorporating a ramjet and third-stage external boosters, is currently under development. These systems are bolstered by thirteen MIM-23 Improved Hawk battalions with seventy-eight launchers, two MIM-14 Nike Hercules battalions with thirty-six launchers, and forty-five Chaparral launchers. The latter two SAM systems are operated by TSQ-73 automated air defense centers and fed information from TPS-43 air search radars.²³ Recently,

Taiwan . . . ordered a Modified Air Defense System (MADS) based on major elements of the Patriot system. . . . The system will be delivered from September 1996 and will

²⁰ U.S. General Accounting Office, *Impact of China's Military Modernization*, p. 21.

²¹ Tony Cullen and Christopher F. Foss, eds., *Jane's Land-based Air Defence* (hereafter *Jane's LAD*) 1995-96 (Surrey, England: Jane's Information Group Limited, 1995), p. 22; Blake, ed., *Jane's REWS 1995-96*, pp. 30, 154-55; Laur and Llanso, *Encyclopedia of Modern U.S. Military Weapons*, pp. 324, 326, 355-56; and Blake, ed., *Jane's REWS 1992-93*, pp. 71, 77, 123.

²² Cullen and Foss, eds., *Jane's LAD 1995-96*, p. 154.

²³ Duncan Lennox, ed., *Jane's Strategic Weapon Systems* (hereafter *Jane's SWS*) (Surrey, England: Jane's Information Group Limited), issues 5, 11; Cullen and Foss, eds., *Jane's LAD 1995-96*, pp. 22, 342; Blake, ed., *Jane's REWS 1995-96*, pp. 30, 154-55; and Blake, ed., *Jane's REWS 1992-93*, p. 123.

consist of fire units for three batteries, and about 200 PAC-2 rounds. When operational it will provide all-altitude anti-aircraft defence and limited anti-tactical ballistic missile coverage for the Taipei metropolitan area.²⁴

Still, Taiwan's aging fleet of F-104s and F-5Es would appear to be no match for China's Su-27s. President Lee Teng-hui admitted the aircraft are so fatigued that the Taiwanese air force "cannot fly [its] F-104s and F-5Es because [it has] lost so many pilots [in crashes]." ²⁵ Even so, the F-5E remains a capable platform against Chinese J-5, J-6, and even J-7 aircraft, which comprise the majority of Chinese air units. More significant, Taiwan is modernizing its fighter forces with imported F-16A/Bs and Mirage 2000-5Ei/Dis as well as domestically built Ching-kuo aircraft. The first thirty Mirage 2000-5Ei/Dis were delivered in May 1996 and deliveries of F-16A/Bs began in July 1996.²⁶ An initial thirty-eight Ching-kuo fighters, developed in conjunction with General Dynamics (airframe), Garrett (engine), and Westinghouse (radar systems), came into active service in 1995. Once the final deliveries of these aircraft are made, Taiwan's air force will surpass China's in modern fighters, even when one includes the full procurement of seventy-two Su-27s and about 124–140 J-8I/IIIs. Moreover, the engines aboard the F-16A/B and Mirage 2000-5Ei/Di, the F100-PW and M53-P2, require substantially less maintenance than their Chinese counterparts—about one overhaul every 1,300 hours. Unlike the mono-pulse radars found on most Chinese-built aircraft, the GD-53 coherent-pulse Doppler radar aboard the Ching-kuo incorporates advanced elements from both its predecessor APG-67(V) and the F-16's APG-66 radar. In terms of training, Taiwanese pilots average 180 hours of rigorous flight time each year, while Chinese pilots flying advanced aircraft are restricted to navigation flights and basic maneuvers since their commanders are fearful of damaging any of their small number of advanced planes.²⁷

Above all, Taiwan controls a critical force multiplier in its four E-2C AEW aircraft. Originally equipped with the APS-504(V)5 air and surface search radar, the E-2Cs were upgraded with the APS-145. Using its improved air and surface search radar, the E-2C can detect and track more than two thousand different contacts out to a range of 644 km. The APS-145 features sophisticated environmental processing and electronic counter-countermeasures (ECCM) that significantly reduce ground clutter and assure high performance in dense

²⁴ Cullen and Foss, eds., *Jane's LAD 1995–96*, p. 22.

²⁵ "We Must Defend Ourselves," *Newsweek*, May 20, 1996, p. 38.

²⁶ See "Chinese Threat Prompts Taiwan Budget Rise," *Jane's Defence Weekly*, June 12, 1996, p. 19; "Mirage for Taiwan," *Jane's Defence Weekly*, May 29, 1996, p. 13; and Jackson, Munson, and Taylor, eds., *Jane's All the World's Aircraft 1995–96*, p. 574.

²⁷ See Joseph Kahn and Claudia Rosett, "China and Russia Rekindle Their Romance," *Wall Street Journal*, Apr. 24, 1996; Patrick E. Tyler, "China to Buy 72 Advanced Fighter Planes From Russia," *New York Times*, Feb. 7, 1996; Allen, Krumel, and Pollack, *China's Air Force Enters the 21st Century*, pp. 125, 130, 206; Jackson, Munson, and Taylor, eds., *Jane's All the World's Aircraft 1995–96*, pp. 62, 84–88, 431–32, 569–76; IISS, *The Military Balance 1995/96*, pp. 171, 193; Nicholas D. Kristof and Sheryl WuDunn, *China Wakes: The Struggle for the Soul of a Rising Power* (New York: Times Books, 1994), p. 382; and Blake, ed., *Jane's REWS 1992–93*, pp. 259–60.

electro-magnetic and jamming environments. The APS-145 is supplemented by the ALR-73 passive detection system. Four E-2Ds, which will probably integrate new equipment based on Raytheon's Model 940 mission computer, a processor from the same family of hardware used by the advanced E-8C Joint-STARS, have been ordered by Taipei.²⁸ Chinese pilots, with relatively few modern aircraft, inadequate training, and no AEW assistance would thus be hard pressed to penetrate Taiwan's air defenses.

Defensive operations. In the 1980s, NATO air forces preparing for a Warsaw Pact assault were directed, not only to resist Pact air supremacy in the air, but also to engage in deep-strike interdiction to influence the forward air battle by damaging or destroying enemy air bases. Taiwanese air forces, unless restricted from doing so, would likely target Chinese air bases in similar fashion. Although China's air search radars are plentiful, most are unable to detect low-flying aircraft. Further, China lacks an apparatus for the quick processing and dissemination of targeting information to local air defense commanders. That is a result, in part, of the Chinese military's *duo yanzhi, shao zhuangbei, xinlao bingcum, zhubu gengxin* procurement policy, which assigned priority to research and development and directed that, in combat units, "old weapons would be maintained alongside new ones and would only be gradually replaced."²⁹ Consequently, it is uncertain whether China's vast but highly varied radar systems could be networked effectively to provide commanders with an accurate real-time image of their tactical environment. Currently, China's most advanced information system is the tactical JY-10 Radar Information Processing Post and TADS II tactical air defense system, which can manage up to eight simultaneous interceptions.³⁰ Nonetheless, "China lacks a central and computerized [national] air defence system, and [as a result] responsibility for airspace control rests largely with local area headquarters." To be sure, a French company supplied China in the 1980s with "six long-range radars, three terminal area radars, and control centers for airspace management." However, these systems were installed in the Beijing and Shanghai regions.³¹ Similarly, China's four Russian-built S-300PMU1 (SA-10) mobile SAM batteries, delivered in March 1993 to a northern Chinese port, were deployed near Beijing. The S-300PMU1 is a highly effective system that can engage simultaneously up to six targets out to a range of 47 km for targets above 2,000 meters and 25 km for targets below 25 meters. Beijing is considering the purchase of 100 to 150 S-300PMU1 units, worth approximately \$1.5 billion. In late 1995, China revealed its KS-1 SAM,

²⁸ See Jackson, Munson, and Taylor, eds., *Jane's All the World's Aircraft 1995-96*, pp. 617-18; Blake, ed., *Jane's REWS 1995-96*, p. 292; Laur and Llanso, *Encyclopedia of Modern U.S. Military Weapons*, pp. 54-57, 317; Blake, ed., *Jane's REWS 1992-93*, pp. 212, 240, 482-83; and IISS, *The Military Balance 1995/96*, p. 172. The systems and subsystems found aboard different E-2C, S-2T, and S-70C(M)1 aircraft vary widely. Since these systems and subsystems make these aircraft effective combat platforms, every effort was expended to isolate those systems and subsystems found aboard those aircraft in service in Taiwan.

²⁹ Lewis and Xue, *China's Strategic Seapower*, p. 101.

³⁰ Peter Rackham, ed., *C4I Systems 1994-95* (Surrey, England: Jane's Information Group Limited, 1994), p. 84.

³¹ Cullen and Foss, eds., *Jane's LAD 1995-96*, p. 6.

which is purported to have a range of 42 km and a maximum altitude of 25,000 meters.³²

Until these new air defense units come on line in Fujian, however, Taiwan's F-16A/B, Mirage 2000-5Ei/Di, and Ching-kuo fighter aircraft, aided by E-2cs, retain the ability to penetrate Chinese air defenses. The utility of China's hundreds of outmoded surface-to-air missile systems is dubious. Although it is true that a U.S. Air Force F-16C was successfully downed by a relatively aged SA-6 SAM in June 1995, the pilot was flying at a high altitude. Taiwanese aircraft would likely approach the Chinese coast at barely 20 meters above sea level. Their primary targets, similar to those of their Chinese counterparts, would be air defenses and C³ centers, followed by air bases and their attendant machine shops, and, lastly, military concentrations and transportation networks.

Ballistic Missiles

Unlike air operations, a Chinese ballistic-missile attack could not be easily blunted by Taiwan's defenses. With a range of 600 km, China's DF-15 (M-9) mobile solid-propellant ballistic missiles based in Fujian could comfortably strike targets throughout Taiwan. Tested near Taiwan in 1995, four more DF-15s were used in the March 1996 missile tests. Although its accuracy against mobile or point targets is questionable, with a circular error probable of 300 meters, the DF-15 can certainly hit large stationary targets such as a military base or population center. Though Beijing would likely use conventional warheads, there always exists the possibility that it would choose to employ biological, chemical, or nuclear warheads. In any event, there is no indication that Taiwanese efforts to destroy DF-15 missiles would fare any better than U.S. efforts to destroy Iraqi Scud missiles in 1991.³³

Correlation of Sea Forces

Even if its air defenses remained intact Taiwan would still be vulnerable to a blockade at sea. (Despite an unprecedented airlift during the Persian Gulf conflict, U.S. forces still relied on sealift for more than 95 percent of their fuel

³² See "KS-1 SAM System Revealed," *Jane's Defence Weekly*, Dec. 2, 1995, p. 5; U.S. General Accounting Office, *Impact of China's Military Modernization*, p. 23; Cullen and Foss, eds., *Jane's LAD 1995-96*, pp. 126-28; Tai Ming Cheung, "China's Buying Spree," *Far Eastern Economic Review*, July 8, 1993, pp. 24-26; and Tai Ming Cheung, "Sukhois, Sams, Subs," *Far Eastern Economic Review*, Apr. 8, 1993, p. 23.

³³ U.S. General Accounting Office, *Operation Desert Storm: Evaluation of the Air War* (Washington, D.C.: U.S. General Accounting Office, July 1996), pp. 9-11; Lennox, ed., *Jane's SWS*, issue 16; Tyler, "China Says Maneuvers Will Last Through Taiwan's Elections"; Patrick E. Tyler, "Beijing Steps Up Military Pressure on Taiwan Leader," *New York Times*, Mar. 7, 1996; "China Goes Ballistic," p. 23; "Free-for-all," *The Economist*, July 29, 1995, pp. 23-24; Norman Friedman, "World Naval Developments," *Proceedings*, Sept. 1995, p. 91; and John Wilson Lewis, "China's Ballistic Missile Programs: Technologies, Strategies, Goals," *International Security*, Fall 1992, pp. 5-36.

Table 3
Chinese Navy, 1996

	North Sea Fleet	East Sea Fleet	South Sea Fleet	Station Unknown	Building or Planned	Reserve
<i>Submarines</i>						
Xia	1					
Golf	1					
Han	5					
Kilo	2				2	
Song	1				2	
Ming	5 (a)	5 (a)	3			
Modified Romeo	1					
Romeo	11-13 (b)	11-13 (b)	11-12 (b)			27
<i>Destroyers</i>						
Luhu	2				2	
Luda III			1		1	
Luda I/II	6	4	5			
<i>Frigates</i>						
Jiangwei		5			1	
Jianghu III/IV		3				
Jianghu II	1					
Jianghu I	5	7	9-13	2		
Jiangnan			0-1			
Chengdu			0-2			
<i>Missile craft</i>						
Houjian or Huang				1-2	2	
Houxin			9-15		3	
Huangfen and Hola (Osa I)				67		35
Hegu or Hoka and Hema (Komar)				48		25
<i>Mine warfare</i>						
T-43	10	9	8			6-8

Source: Table compiled by author from a variety of sources.

(a) Distribution of these ten Ming-class submarines reflects reports that they have been equally active in both fleets; however, there may be evidence that their deployment is shifting from the East Sea Fleet to the North Sea Fleet.

(b) Uniform division of these Romeo-class submarines reflects reports that each Chinese fleet possesses two squadrons of Romeo class.

and equipment.³⁴) However, to intercept Taiwanese shipping, Chinese naval forces must be able to operate along all of the island's coasts—particularly off its eastern shore. An examination of current Chinese strategy reveals that China

³⁴ See U.S. Department of Defense, *Conduct of the Persian Gulf War*, p. 390. See also George W. Baer, *One Hundred Years of Sea Power: The U.S. Navy, 1890-1990* (Stanford, Calif.: Stanford University Press, 1994), pp. 448-49.

Table 4
Taiwanese Navy, 1996

	Active Service	Building, Transfer, or Planned	Reserve
<i>Submarines</i>			
Hai Lung	2		
Guppy II	2		
<i>Destroyers</i>			
Chien Yang	7		
Fu Yang	6		
Allen M. Sumner			2-4
Fletcher			3-4
<i>Frigates</i>			
Cheng Kung	4	3	
Tien Tan		4	
Kang Ding	1	5	
Knox	6	6	
<i>Corvettes</i>			
		10	
Auk	3		
Rudderow	1		
Charles Lawrence	1		
Crosley	4		
<i>Missile craft</i>			
Jin Chiang	1	12	
Lung Chiang	2		
Hai Ou	49-50		
<i>Mine warfare</i>			
Aggressive	4		
Yung Feng	4	2	
Adjutant and MSC 268	5		

Source: Table compiled by author from a variety of sources.

is "replacing its customary 'coastal defense strategy [*jinbai fangyu zhanlue*]' with an 'operational maritime strategy [*jinglue haiyang zhanlue*].' The focus is on medium range sea areas beyond the 200 nautical mile limit."³⁵ Under the new strategy, naval bases may determine their own combat assignments and defense perimeters according to a twelve-character guideline that translates as "quick reaction in case of need, maneuver swiftly in vast sea areas, and conduct combined operations by various arms."³⁶ Consequently, Taiwan's eastern coast would be well within the scope of Chinese operations. (See Tables 3 and 4.)

Surface warfare. Although Chinese destroyers and frigates could elude Taiwan's coastal missile and gun batteries by sailing far out to sea, they could

³⁵ Xiao Bing and Qing Bo, *Zhongguo Jundui Nengfou Daying Xia Yichang Zhanzheng?* (1993; reprint, Taipei: Chouchih Wenhua Press, 1995), p. 10, reprinted in Jeffery B. Goldman, "China's Mahan," *Proceedings*, Mar. 1996, p. 45.

³⁶ Lewis and Xue, *China's Strategic Seapower*, p. 294 n. 136, p. 323 n. 119.

not as easily evade the Taiwanese navy. To be sure, Chinese forces could launch ship-based cruise missiles like the HY-2 (C-201), a derivative of the Soviet SS-N-2a Styx that has a range of 95 km. Most newer ships are fitted with the more accurate YJ-1 (C-801), which has inertial and active radar guidance and a range of 32–40 km. The successor to the YJ-1, the developmental YJ-2 incorporates a turbojet engine, giving it a range of 120 km, as well as some ECCM features. But unfortunately for China, Taiwanese ships deploy the antiship Hsiung Feng 2 missile (range 80 km) as well as the American-built RGM-84D Harpoon, which has a range of 124–130 km and can be targeted by E-2Cs for improved precision over extended ranges. The 127 mm guns aboard Taiwan's Tien Tan-class and Knox-class frigates have excellent fire-control directors that give them greater accuracy than the Chinese navy's 130 mm or 100 mm guns. Lastly, Taiwan's 127 mm guns are capable of firing as many as forty rounds each minute, while their Chinese counterparts can achieve only seventeen or eighteen rounds per minute. In the meantime, the absolute number of operational Chinese surface combatants has slightly declined for the moment with the recent retirement of the last two Jiangdong-class frigates as well as a number of Jiangnan-class and Chengdu-class frigates.³⁷

Anti-air warfare. An evocative photograph released by *Xinhua* and prominently published in *Newsweek* depicted a Jiangwei-class frigate, the *Tongling*, 542, exercising its HQ-61 (or RF-61) SAM launcher. It seemed an impressive display, but in fact Chinese anti-air warfare capabilities are limited, particularly against an adversary with stand-off munitions.³⁸ Although Chinese ships are equipped with Hai Ying and Rice Screen air search radars that can detect airborne targets 180 km distant, only two Luhu-class and three Luda-class destroyers are outfitted with the modern French-built Crotale SAM system that can engage aircraft out to a range of 13 km. Each Crotale launcher can accommodate eight missiles. The only other ships in the PLAN inventory equipped with surface-to-air missiles are five Jiangwei-class frigates, which are fitted with Chinese-built sextuple HQ-61 launchers and PL-9 SAMs. These missiles have an effective range of 8.5–10 km and can reach an altitude of 5,000 meters.³⁹

³⁷ Jane's reports that the YJ-1 and RGM-84D have ranges of 40 km and 130 km, respectively, while the Naval Institute reports that the YJ-1 and RGM-84D have ranges of 32 km and more than 124 km, respectively. The HY-2 is the successor to the HY-1 (NATO designator Silkworm). Lennox, ed., *Jane's SWS*, issues 15, 17; Richard Sharpe, ed., *Jane's Fighting Ships 1996–97* (Surrey, England: Jane's Information Group Limited, 1996), pp. 117–24; Sharpe, ed., *Jane's Fighting Ships 1995–96*, pp. 119–26, 696–97; IISS, *The Military Balance 1995/96*, pp. 171, 177; and Bernard Pr zelin and A.D. Baker III, eds., *The Naval Institute Guide to Combat Fleets of the World 1993* (Annapolis, Md.: Naval Institute Press, 1993), pp. 87, 784.

³⁸ Melinda Liu and Sam Seibert, "Chinese Fireworks," *Newsweek*, Mar. 18, 1996, p. 30.

³⁹ The HQ-61 is derived from a land-based variant that has proven to be unreliable. According to *Jane's LAD 1995–96*, the land-based variant of the PL-9 has a range of 8.5 km while *Jane's Fighting Ships 1995–96* reports that the PL-9 has a range of 10 km. *Jane's Defence Weekly* reports that the sextuple SAM launcher aboard Jiangwei-class frigates may not be designated HQ-61 and may actually be designated RF-61. "China Exercises RF-61 Surface-to-air Missile," *Jane's Defence Weekly*, Nov. 11, 1995, p. 5; Sharpe, ed., *Jane's Fighting Ships 1996–97*, pp. 117–24; Blake, ed., *Jane's REWS 1995–96*, p. 175; and Cullen and Foss, eds., *Jane's LAD 1995–96*, pp. 112–13, 257–59.

However, this SAM system, under development since the 1960s and first deployed in the 1980s, has had a history of problems, while further construction of Luhu-class destroyers has been delayed by a shortage of LM 2500 propulsion gas turbines.⁴⁰

Three of Taiwan's four new frigate classes, by contrast, are well armed with surface-to-air missile defenses. One, the Tien Tan class (Oliver Hazard Perry), is a dedicated anti-air warfare platform. When launched, it will house not only the ADAR-2N phased-array radar, similar to the American SPY-1D Aegis, but also a forty-eight-cell Mk 41 vertical-launch system with the very accurate American-built RIM-66C Standard SM-2MR. The RIM-66C is a semi-active homing SAM with mid-course guidance correction and ECCM systems, and it has a range of either 74 or 167 km depending on the variant purchased. Two Phalanx systems will provide close-in defense. The Cheng Kung-class (Oliver Hazard Perry) and Kang Ding-class (La Fayette) frigates are also furnished with highly capable air search radars like the SPS-49(V)5 and Thomson-CSF Jupiter, which have detection ranges of 463 km and 215 km, respectively. The Cheng Kung class deploys RIM-66B Standard SM-1MR missiles, which have a range of 46 km and are fired from an Mk 13 reloading launcher. The Kang Ding class is armed with the Crotale CN2, an advanced variant of the original with a range of 13 km. Both frigate classes are fitted with one Phalanx system apiece.⁴¹

The relative weakness of Chinese surface warfare and anti-air capabilities, as well as the PLAN's small number of underway replenishment ships, would preclude Chinese surface forces from assuming an effective role in a blockade of Taiwan's eastern and southern coasts without the risk of substantial losses.

Submarine warfare. Consequently, the burden of a sea blockade would fall upon the Chinese navy's fifty-two to sixty active tactical submarines.⁴² These elusive combatants, by engaging Taiwanese shipping directly or seeding Taiwan's sea lanes with naval mines, would certainly represent a serious challenge to Taiwanese antisubmarine warfare (ASW) forces and give Beijing its best hope for an effective blockade. Accordingly, China has made a concerted effort to

⁴⁰ "Combat Fleets," *Proceedings*, July 1995, p. 86.

⁴¹ See Sharpe, ed., *Jane's Fighting Ships 1996-97*, pp. 691-93; Laur and Llanso, *Encyclopedia of Modern U.S. Military Weapons*, pp. 168-69, 251-53; Prézelin and Baker, eds., *Naval Institute Guide*, p. 784; and Blake, ed., *Jane's REWS 1992-93*, pp. 151-52, 183-84. Both the Tien Tan class and Cheng Kung class were referred to as Oliver Hazard Perry-class frigates. The reason for this anomaly is that the basic hull and systems design of both Taiwanese classes were derived from the Oliver Hazard Perry class; however, the dedicated warfare systems aboard each class differ to such an extent that they warrant different Taiwanese classifications. Similarly, both the Fu Yang class and Chien Yang class were referred to as Gearing-class destroyers.

⁴² Because an indeterminate number of Romeo-class submarines are retired each year or are placed in operational reserve, the absolute number of Chinese submarines varies according to the counter. *Jane's Fighting Ships* reports that thirty-eight Romeo class are in active service while *The Military Balance* reports that thirty-three are in active service. Sharpe, ed., *Jane's Fighting Ships 1996-97*, pp. 115-17; IISS, *The Military Balance 1995/96*, pp. 171, 177; and "Combat Fleets," *Proceedings*, July 1995, p. 86. For a discussion of Chinese submarine capabilities, see Hei Shwei, "Dragons and Centipedes at Sea," *Proceedings*, Nov. 1995, pp. 65-68.

strengthen this arm of the PLAN, as indicated by the Central Military Commission's order to give "the development of submarines . . . precedence over all other [construction]."⁴³

As a result, production of Ming-class submarines continues, while the Han-class and later Ming-class submarines have been fitted with French-built DUUX-5 passive ranging and intercept sonars. Moreover, the first of the new Song class of diesel-electric submarines was launched in May 1994 and was expected to begin sea trials in late 1995.⁴⁴ Although the Song class may have been constructed primarily for export, it is reported to be in series production already. Even more significant was China's decision to purchase four Kilo-class diesel-electric submarines from Russia in mid-1993. While the design of the Kilo class is fairly basic by Western standards, it is a quiet boat and, "with a reserve buoyancy of over 30 percent and a heavily compartmentalized pressure hull," it can withstand a torpedo hit. The first two Kilo-class submarines were delivered in February and September 1995 and were of the Project 877EKM version. The final two, one of which will be launched in 1996, will be of the Project 636 version that incorporates a "quieter propulsion and an automated combat information system capable of providing simultaneous fire control data on two targets."⁴⁵ Some reports indicated that China may procure up to six more Kilo-class submarines, with some to be manufactured under license in China's shipyards. Another, more speculative report indicated that in addition to the six, twelve more may soon be ordered.⁴⁶

Notwithstanding the Kilo-class orders, the large majority of Chinese submarines are upgrades of old designs that still conceal a number of technical deficiencies. Considering the Taiwanese operational environment, these submarines may raise some operational concerns for Chinese commanders.

Technical concerns. Submarines are extremely difficult to outfit and maintain, and they require highly competent crews to operate at peak performance. Thus, the PLAN established the Submarine Academy at Qingdao to "[train] all the men slated for submarine duty and deep-water rescue vehicles from the lowest sailor up." Known as the "blue cradle," the Submarine Academy teaches not only a technical curriculum but also electives such as "psychology, ethics, Western philosophy, and Western economics." In fact, the educational level of submarine commanders and crew members, particularly those selected to serve aboard nuclear submarines, "exceeds that of all other PLA combat units."⁴⁷

⁴³ Lewis and Xue, *China's Strategic Seapower*, p. 228.

⁴⁴ See Anthony J. Watts, ed., *Jane's Underwater Warfare Systems* (hereafter *Jane's UWS*) 1996-97 (Surrey, England: Jane's Information Group Limited, 1996), p. 82; Paul Beaver, "China Continues Ming Submarine Production," *Jane's Defence Weekly*, Sept. 16, 1995, p. 16; Sharpe, ed., *Jane's Fighting Ships 1996-97*, p. 115; and "World Navies in Review," *Proceedings*, Mar. 1996, p. 112.

⁴⁵ Sharpe, ed., *Jane's Fighting Ships 1995-96*, p. 159; Sharpe, ed., *Jane's Fighting Ships 1996-97*, p. 116.

⁴⁶ See "World Navies in Review," p. 110; Sharpe, ed., *Jane's Fighting Ships 1996-97*, p. 116; IISS, *The Military Balance 1995/96*, p. 171; Nayan Chanda, "Fear of the Dragon," *Far Eastern Economic Review*, Apr. 13, 1995, p. 25; Kathy Chen, "China Buys Russian Submarines, Raising Tension Level in Region," *Wall Street Journal*, Feb. 9, 1995; and Cheung, "China's Buying Spree," p. 26.

⁴⁷ Lewis and Xue, *China's Strategic Seapower*, p. 122.

However, it appears that the Submarine Academy may not be generating new submarine crews with adequate haste. One of the reasons cited to explain the decline in the number of operational Romeo-class submarines is the insufficiency of crews.⁴⁸

Chinese technical worries go far beyond maintaining crews for operational submarines. While potentially formidable, the Han-class nuclear attack submarine has labored under significant concerns throughout its development process. The first of its class, the 401, was launched in late 1971, and all through its twenty sea trials between 1972 and 1974 it chronically experienced "misfortunes of varying (and still secret) degrees." When the 401 entered the Chinese navy's order of battle in 1974, it continued to harbor unresolved flaws and, as a consequence, neither the 401 nor the follow-on 402 became fully operational until the 1980s. The 401's crew

found corrosion at stress points in the heat exchanger's piping and repeatedly detected radioactivity in the boat's drainage pipes. Although radioactive elements are normal in the primary loop pipes, the engineers could not figure out how radioactivity had moved from this supposedly hermetically sealed loop to the second-loop drainage system. They also could not solve the leakage of valves in the primary loop.⁴⁹

Even though the 401 and 402 were extensively refitted in the late 1980s, some Chinese specialists confess that "similar problems have yet to be resolved."⁵⁰

Moreover, communications aboard Chinese-built submarines have been notoriously poor. Chinese commanders knew

that Western surveillance systems required only about a few seconds to detect and locate the transmissions of all but the most modern submarines. The best defense against such intercepts, they understood, was to develop technologies for so-called instantaneous communications for both transmission and reception. Institute 1019 in Shijiazhuang, Hebei Province, worked out these technologies, and then developed a high-power microwave system that could communicate via space satellites. In completing this system, other institutes concentrated on making and improving specialized communication satellites, five of which were launched between 1984 and 1990.⁵¹

The General Staff and the PLAN were awarded priority on the majority of the channels aboard these satellites. Although Chinese engineers and scientists solved the problem of very low frequency (VLF) radio transmissions (3–30 kHz), extremely low frequency (ELF) radio transmissions (30–300 Hz) eluded them. "The problem is that VLF radio can penetrate only a few meters below the surface whereas ELF radio can reach 100 or more. A submerged submarine

⁴⁸ Sharpe, ed., *Jane's Fighting Ships 1996–97*, p. 117; Bruce Swanson, *Eighth Voyage of the Dragon: A History of China's Quest for Seapower* (Annapolis, Md.: Naval Institute Press, 1982), pp. 278–79.

⁴⁹ Lewis and Xue, *China's Strategic Seapower*, p. 109.

⁵⁰ See Lewis and Xue, *China's Strategic Seapower*, pp. 109–10; Sharpe, ed., *Jane's Fighting Ships 1996–97*, p. 114; and Prézelin and Baker, eds., *The Naval Institute Guide*, pp. 88–89.

⁵¹ Lewis and Xue, *China's Strategic Seapower*, p. 119.

that is dependent on VLF as its primary means of communications must thus deploy its antennas and patrol near the surface, thereby risking detection.”⁵²

Another area of concern for the Chinese navy is navigation. While operating underwater with restricted emissions conditions, a submarine can easily drift off course as it is buffeted by undersea cross currents. As a result, the PLAN developed a number of coastal high-power radio navigation systems. The first ones came into service in southern China in 1989, while construction of three more was begun the year before in northern and eastern China. Unfortunately for the PLAN, “none of these facilities [has] the capacity to service submarines operating far from China’s coasts.”⁵³ Consequently, submarines operating far from home may veer several kilometers from their intended courses. In peacetime that may be of no great concern, but it can mean the difference between a successful and unsuccessful interception in wartime.

In the mid-1980s, two Chinese research institutes finally

developed a more modern integrated inertial navigation system linked to the U.S. NavStar and Omega (VLF) systems, as well as to on-board optics (for astronomical sightings) and computers. The Chinese apparently were willing to take the risk that the United States might deny them access to its systems in wartime.⁵⁴

However, it is uncertain whether these modern navigation systems have been installed on older Romeo-class submarines. If China were forced to rely solely on its high-power radio navigation systems along its coast, Chinese submarines operating closely along the eastern coast of Taiwan would experience at least some signal degradation caused by the land mass of Taiwan itself as well as possible Taiwanese electronic jamming.

No less distressing to Chinese commanders is the fact that most of their submarines are relatively noisy. The Romeo-class and Ming-class diesel-electric submarines operate with two shafts and two propellers, generating strong acoustic signatures. The noise level of the Xia-class strategic missile submarine, launched in 1981, was described by its crew members as “unbearable.” By the time of its commissioning in 1987, this difficulty was reported to have been resolved. Nonetheless, Han-class nuclear attack submarines, designed from the same technology used to develop the Xia class, can be expected to exhibit at least some of the same acoustic tendencies as the *Xia*.⁵⁵

Operational concerns. In October 1994, American ASW assets, primarily S-3A/Bs, from the *Kitty Hawk* carrier battle group detected and tracked a submerged Chinese Han-class nuclear attack submarine for an extended period in the Yellow Sea. As the submarine headed for its base at Qingdao, “China scrambled [J-6] air force jets that flew within sight of the American battlegroup.”⁵⁶

⁵² Ibid., p. 118.

⁵³ Ibid., p. 119.

⁵⁴ Ibid.

⁵⁵ See “Combat Fleets,” *Proceedings*, July 1995, p. 86; Sharpe, ed., *Jane’s Fighting Ships 1996-97*, pp. 114-17; and Lewis and Xue, *China’s Strategic Seapower*, pp. 117, 120.

⁵⁶ Patrick E. Tyler, “As Deng Fades, China’s Leaders Tighten Grip on Power,” *New York Times*, Dec. 19, 1994. See also Sharpe, ed., *Jane’s Fighting Ships 1996-97*, p. 115.

Afterwards, during an informal gathering, a "Chinese official told a U.S. officer that the next time such an incident occurred so close to Chinese territory, China would send up its latest Su-27 fighters and shoot down the American aircraft."⁵⁷ While the incident eventually diffused, it did reveal that the Han class was not as quiet as many believed it to be and could be detected and easily tracked by airborne ASW assets.

To mitigate the operational shortcomings of their individual submarines, Chinese commanders would probably try to concentrate their submarine forces when attacking a Taiwanese convoy. Because each convoy might have only a few escorts, a concentration of submarines, somewhat reminiscent of undersea operations in World War II, holds the prospect that a convoy's antisubmarine defenses could be compromised and breached. However, Chinese submariners would likely also encounter obstacles similar to those that dogged their American and German predecessors. Concentration requires coordination by a central agent, and coordination requires secure communications. Considering the state of Chinese naval communications, Taiwanese signals analysts may repeat the success of Allied ASW operations in the Atlantic that focused on monitoring and localizing submarine transmissions.⁵⁸

Of the six Chinese tactical submarine classes, only the Han and modified Romeo are known to be armed with antiship missiles. Unfortunately for their crews, they must surface within 33–40 km of their intended target to launch their YJ-1 missiles.⁵⁹ At these ranges, however, escorting Taiwanese frigates would certainly detect the launching submarine with their surface search radars and promptly target their RGM-84D or Hsiung Feng 2 missiles on it. Even if the submarine were not surfaced long enough for the Taiwanese missiles to impact, the frigates would deploy their S-70C(M)1 ASW helicopters or contact patrolling S-2T ASW aircraft to prosecute the submarine.

Still another operational concern of Chinese commanders deals with the PLAN's reliance on diesel-electric submarines. When operating deep underwater, these boats can run only so long as their batteries are charged. The life of a submarine's batteries depends on the submarine's speed; the faster it travels, the more rapidly its batteries run down. The Chinese navy's Kilo class is said to be capable of traveling as far as 1,000 km at five knots before its batteries are completely depleted; however, at such a slow sustained speed, the Kilo class would be hard pressed to reach an advantageous firing position against a fast convoy. The distances between the Chinese submarine base at Ningbo and the ports of Chi-lung, at the northeastern end of Taiwan, and T'ai-tung, at the southeastern end of Taiwan, are 520 km and 795 km, respectively, for a straight-line course over waters with a minimum depth of 200 meters.⁶⁰ To

⁵⁷ Nigel Holloway, "Closer Encounters," *Far Eastern Economic Review*, Apr. 13, 1995, p. 30.

⁵⁸ Baer, *One Hundred Years of Sea Power*, pp. 189–205.

⁵⁹ See Barbara Starr, "Designed in China: A New SSK is Launched," *Jane's Defence Weekly*, Aug. 13, 1994, p. 3; Sharpe, ed., *Jane's Fighting Ships 1996–97*, pp. 115–16.

⁶⁰ Kilo class battery capacity and distances between the Ningbo submarine base and the ports of Chi-lung and T'ai-tung are the author's estimates.

compensate, all Chinese diesel-electric submarines are fitted with snorkel masts that allow them to operate their diesel engines and charge their batteries without surfacing. The snorkel mast protrudes above the ocean surface to eject the toxic exhaust generated from the submarine's diesel engines, while replenishing its air supply. However, to charge its batteries fully, a submarine may be forced to snorkel for several hours, effectively slowing its speed. More important, running with a snorkel exposed for an extended period would provide Taiwanese ASW operators with five exploitable signatures: acoustical, exhaust, infrared, visual, and radar.

Lastly, the Chinese navy needs to continue to improve its readiness. "In 1982, fewer than ten vessels were able to pass the qualifying tests [for round-the-clock alert]." A stern training regimen increased that number to about half the PLAN's ships by 1987, but more surely needs to be done.⁶¹

The Chinese navy relies on diesel-electric submarines, which must recharge their batteries frequently.

The opposing force. Taiwan's ASW capabilities have improved dramatically since 1990 when its first Cheng Kung-class frigate was laid down. The Taiwanese navy's old ASW forces, based on obsolete SQS-23 and SQS-29 hull-mounted active sonars with vacuum tube transmitters, are being replaced by modern hulls and ASW equipment. The last two to four Allen M. Sumner-class and three to four Fletcher-class destroyers, all of which are in poor condition, will be retired once new ships are commissioned to replace them. Similarly, Taiwan's remaining

Rudderow-class, Charles Lawrence-class, and Crosley-class corvettes will be either relegated to fishery duties or decommissioned.⁶² In any event, these ships would have been no match for the Chinese navy's Kilo-class diesel-electric submarines. Nevertheless, Taiwan's thirteen Chieng Yang-class (Gearing) and Fu Yang-class (Gearing) destroyers, though old, have had their sonars upgraded to the SQS-23H configuration by incorporating the Raytheon Solid-State Transmitter, which replaced the vacuum tubes of the original SQS-23 model. As a result, the SQS-23H offers improved reliability and maintainability. In addition, some of Taiwan's destroyers are equipped with the German-designed DSQS-21CZ sonar.⁶³

Among the ships that are coming on line, the Cheng Kung-class, Kang Ding-class, and Knox-class frigates have been fitted with the most capable ASW equipment. Four of the Cheng Kung class have already been commissioned; two more will be commissioned in 1997; and a seventh will follow in 1998.⁶⁴ The Cheng Kung class was patterned after the American Oliver Hazard Perry class, which is "not particularly fast or sophisticated, but [is] cheap and designed

⁶¹ Lewis and Xue, *China's Strategic Seapower*, p. 124.

⁶² See Sharpe, ed., *Jane's Fighting Ships 1996-97*, pp. 687-94; IISS, *The Military Balance 1995/96*, p. 192.

⁶³ Watts, ed., *Jane's UWS 1996-97*, p. 56; Watts, ed., *Jane's UWS 1995-96*, p. 50; and Watts, ed., *Jane's UWS 1992-93*, pp. 37, 55.

⁶⁴ Sharpe, ed., *Jane's Fighting Ships 1996-97*, pp. 691-93.

for easy maintenance.”⁶⁵ Taiwan's first Kang Ding class arrived in May 1996, and two more are scheduled to follow before the end of 1996. Three more will be completed by July 1998. Although the French government authorized the sale or licensed production of up to ten further Kang Ding-class frigates, Taipei may opt to construct ten less-expensive 1,500-ton, Hsiung Feng 2-armed corvettes of a new class. Six Knox-class frigates have already been delivered in two batches of three; the initial three were commissioned in October 1993, three more in August 1995, and “two additional batches of three are planned.”⁶⁶ All these ships are equipped with high-power, low-frequency sonar systems: either the SQR-18A(V)1 passive towed-array sonar or the ATAS active towed-array sonar.⁶⁷

The SQR-18A(V)1 passive towed-array sonar, emphasizing digital signal-processing techniques to present simultaneously both narrow- and wide-band information, can reduce false acoustic alarms as well as integrate transmitted helicopter data. The ATAS active towed-array sonar combines the best features of active variable-depth sonars and passive towed arrays. Trailed 900 meters behind the frigate, along with a receiver array a further 300 meters behind the transmitter, the ATAS can operate down to 235 meters beneath the ocean surface. Normal reception ambiguity is automatically and instantaneously resolved.⁶⁸ These powerful surface ASW assets are reinforced by Taiwan's thirty-one S-2T aircraft.⁶⁹ Outfitted with the AQS-902F acoustic processor, the S-2T greatly benefits from an acoustic localization plot that presents its operator with a geographical image of both sonobuoy positions and contact bearing lines.⁷⁰ Also, all of Taiwan's new frigates will be equipped with S-70C(M)1 ASW helicopters, including the anti-air Tien Tan class.

Nonetheless, the best countervailing force to a submarine threat is the submarine itself. Operating on the same side of the thermocline as the target gives submarine sonars a decided advantage over those operated from the ocean surface. Unfortunately for Taiwan, since its procurement of two Dutch-built Hai Lung-class (Zwaardvis) diesel-electric submarines in 1987 and 1988 to augment its two Guppy II-class submarines, its efforts to purchase additional units have been frustrated by Beijing. A highly automated design, the Hai Lung class integrates the Sperry Mk 29 Mod. 2A inertial navigation system and the Sinbads M weapons control system, which can track simultaneously eight

⁶⁵ Baer, *One Hundred Years of Sea Power*, p. 405.

⁶⁶ “Combat Fleets,” *Proceedings*, Jan. 1996, p. 93. See also Sharpe, ed., *Jane's Fighting Ships 1996-97*, pp. 692-93; “Combat Fleets,” *Proceedings*, June 1996, p. 86; and “Naval Boost,” *Far Eastern Economic Review*, Apr. 11, 1996, p. 13.

⁶⁷ Sharpe, ed., *Jane's Fighting Ships 1996-97*, pp. 691-93.

⁶⁸ Watts, ed., *Jane's UWS 1996-97*, p. 59; Watts, ed., *Jane's UWS 1995-96*, pp. 47-49; and Watts, ed., *Jane's UWS 1992-93*, pp. 36, 49-51.

⁶⁹ “Taiwanese S-2T Crash,” *Jane's Defence Weekly*, June 12, 1996, p. 20.

⁷⁰ Mark Lambert, ed., *Jane's All the World's Aircraft 1991-92* (Surrey, England: Jane's Information Group Limited, 1991), p. 410; Watts, ed., *Jane's UWS 1992-93*, pp. 23-24.

different targets. After failed attempts to acquire German-built Type 209-class, French-built Agosta-class, and further Dutch-built submarines, Taiwan continues its plans to procure ten to twelve attack submarines.⁷¹

Naval mines. An inexpensive agent, the naval mine offers a way for Chinese submarines to close the approaches to Taiwanese ports passively. The PLAN possesses a wide selection of Soviet-designed contact and influence naval mines. China's Dalian Warship Institute is currently developing a moored mine that incorporates both a ship counter-system that can permit up to fifteen actuations before detonation and a delay mechanism before arming itself—allowing minefields to remain undetected until they become areas with high ship traffic.⁷²

Beijing has thwarted Taiwan's efforts to buy more submarines.

Mines proved effective in the Persian Gulf conflict by disabling modern ships like the cruiser *Princeton* and amphibious-landing ship *Tripoli*. A moored contact mine struck the *Tripoli* in thirty meters of water; soon thereafter, the *Princeton* actuated an influence mine in sixteen meters of water while another mine detonated sympathetically nearby. Mine-hunting technology lags badly, and American ships operating in the Gulf relied primarily on mine watchers stationed on the bow of each vessel to locate potential mines.⁷³ More sophisticated methods

employ helicopters with acoustic and magnetic mine countermeasures (MCM) sleds, which simulate a ship's propellers and magnetic signature to detonate influence mines.

Chinese submarines carrying twenty-four to thirty-two naval mines each could, over time, seed many minefields in Taiwan's sea lanes. In contrast, the Taiwanese navy's MCM capabilities are weak, particularly as it retires a number of old Adjutant-class and MSC 268-class coastal minesweepers. However, Taiwan is procuring two additional Yung Feng-class coastal minehunters, which are fitted with the French-built IBIS V mine-hunting system, as well as two PINGUIN B3 remote operating vehicles that can disable naval mines from a distance. Taiwan also plans to build a new class of minehunters.⁷⁴

Of course, relegating Chinese submarines to a mine-laying role would detract from either the overall number of submarines available for direct interception or the firepower that each submarine could bring to bear. Moreover, Chinese commanders would have to be extremely judicious in their placement of minefields since neutral shipping not bound for Taiwan may also ply waters near the island.

⁷¹ "Knock-Up Subs," *Far Eastern Economic Review*, Apr. 18, 1996, p. 12; James E. Wright, "Submarine Design for the Littorals," *Proceedings*, Dec. 1995, p. 40; Sharpe, ed., *Jane's Fighting Ships 1995-96*, pp. 690-91; and Prézelin and Baker, eds., *The Naval Institute Guide*, pp. 681-82.

⁷² Watts, ed., *Jane's UWS 1996-97*, p. 208; Watts, ed., *Jane's UWS 1995-96*, pp. 188, 194-96.

⁷³ U.S. Department of Defense, *Conduct of the Persian Gulf War*, pp. 200, 206-8.

⁷⁴ Sharpe, ed., *Jane's Fighting Ships 1995-96*, pp. 116-18, 700-701; Watts, ed., *Jane's UWS 1996-97*, pp. 252, 288.

Shallow waters. Despite the absence of a thermocline, shallow waters can significantly hinder the ability of active and passive sonar to detect, localize, and track submerged submarines. Accordingly, many navies fear the potential of submarines in these shallow, or littoral, waters. The proximity of the sea floor at shallow depths poses four principal obstacles to simple acoustic propagation (the transmission of sound through a medium): the transition from spherical to cylindrical sound spreading, sea surface roughness that tends to scatter sound waves, the disproportionate effect of bottom absorption, and the unpredictable nature of bottom reflection.⁷⁵ For example, passive sonar operating in shallow waters is likely to detect, not just the acoustic signatures of submarine contacts, but also those of large schools of fish and even water itself flowing around the rocky spires of the ocean floor. These false echoes can frustrate the most sophisticated ASW technologies and techniques. Unfortunately for Taiwan's ASW operators, the waters around Taiwan are rich with organisms and have irregular sea floors, particularly those off the southeastern coast. In fact, ASW operations have been reported to be very difficult in and around the Luzon Strait.⁷⁶

Taiwanese leaders, recognizing this challenge, ordered construction of an oceanographic research ship in June 1993. Launched on December 17, 1994, in Italy and commissioned on September 26, 1995, in Taiwan, the *Ta Kuan*, a near duplicate of the NATO-operated *Alliance*, represents a real improvement in Taiwan's ASW capability. Although officially under the aegis of Taiwan's Ministry of Transport and Communications, the 3,180-ton ship is operated by naval personnel and supports the undersea sound range off the eastern coast of Taiwan. The *Ta Kuan* can, with high precision, test acoustic propagation in these waters with its deep and shallow echo-sounders as well as its Simrad sidescan sonar EM 1200. Noise emanating from the ship itself is abated by an electric drive and a 1,605-kW gas turbine, which is mounted on the ship's superstructure. The steady positioning of the *Ta Kuan* is ensured by a dynamic positioning system that integrates a bow thruster, a stern positioning propeller, and Navsat and Satcom data links.⁷⁷

The Scenario

To conduct an undersea blockade of Taiwan, China must sustain a submarine force at sea to patrol, at minimum, the approaches to Taiwan's eastern and southern ports, where Taiwanese forces would most likely try to break the blockade. Affording better protection from Chinese air operations

⁷⁵ Michael Ford, "Predicting Acoustic Propagation in Shallow Water," *Proceedings*, Dec. 1995, pp. 69–72.

⁷⁶ During World War II, the waters of the Luzon Strait were prime hunting grounds for American fleet submarines operating against Japanese commerce between the Netherlands East Indies and Japan. See Baer, *One Hundred Years of Sea Power*, pp. 231–37.

⁷⁷ "Combat Fleets," *Proceedings*, Feb. 1996, p. 93; Sharpe, ed., *Jane's Fighting Ships 1995–96*, p. 701.

because of their geography, these ports—like Chi-lung, Su-ao, Hsin-ch'eng, Hua-lien, T'ai-tung, and Kao-hsiung—possess the facilities, rail links, and road networks for rapid transshipment of off-loaded supplies throughout the island. Assuming an 80 percent readiness rate in the PLAN at the outbreak of hostilities, the blockading submarine force would probably consist of two Han-class, one to two Kilo-class, three to four Ming-class, and ten to thirteen Romeo-class submarines, approximately one-third of the Chinese navy's ready submarine complement, drawn from all three Chinese fleets.

Sensitive to the submarine threat to their sea lanes, Taiwanese commanders would be helped by the fact that many modern merchant ships can steam at speeds up to fifteen knots, only two and three knots slower than the maximum submerged speeds of Kilo-class and Ming-class submarines, respectively. Thus, even marginal miscalculations by a Chinese commander could place his boat out of range to intercept these ships. Moreover, Taiwanese commanders would likely convoy their most important shipping from assembly points in international or, preferably, nearby national waters of Japan or the Philippines. If use of such national waters were denied, the Taiwanese would probably choose the western Philippine Sea as an assembly point. Free of choke points and buffered from the South China Sea by the Philippine islands, the western Philippine Sea is far removed from the PLAN's two most powerful fleets, based at Qingdao and Ningbo. Thus, Chinese submarines surging to intercept the Taiwanese convoy at its assembly point would be forced to sail great distances, operate with uncertain communications and navigation, and, in the case of diesel-electric submarines, snorkel for an extended period.

Unfortunately for Taiwan, Chinese satellite reconnaissance would likely detect the unusual concentration of shipping in the Philippine Sea. Moreover, increased activity by the Taiwanese navy to clear suspected naval minefields and by E-2C and S-2T aircraft to search for possible Chinese submarines would certainly attract the attention of Chinese signals analysts. However, Chinese commanders would remain dubious as to the precise composition, course, or speed of the convoy since the Taiwanese would most likely attempt to use passing weather fronts to cloak themselves from overhead observation, while the limited number of Chinese reconnaissance satellites would preclude real-time information. Nevertheless, the mere existence of the convoy would spur the Chinese navy to deploy some of its submarines to intercept.

Conscious of Chinese satellite surveillance, the Taiwanese convoy would periodically alter its course toward a different port to confuse and frustrate its pursuers. Even with updated intelligence regarding the convoy's course and speed, Chinese submarines would still need to make constant course corrections. Those submarines unable to receive reliable communications from fleet headquarters might deviate so far off course as to miss the convoy altogether. As a consequence, Chinese submarines would be forced to come to a shallow depth each day and raise their antennae to receive or transmit information. Moreover, since diesel-electric submarines cannot maintain high speeds over extended periods on batteries alone—and no submariner wants to risk having depleted batteries once the enemy has been engaged—they would be forced to raise

their snorkels during at least part of their approach on a convoy, thereby exposing themselves to detection by Taiwan's ASW assets.

Darkness could also complicate a submarine attack. Hence, Taiwanese commanders would probably order their convoy to make its final approach into shallow waters and port under cover of night. In that case, submarines wishing to charge their batteries before engaging the convoy would have their relatively warm snorkels above the colder water (particularly in the winter or spring) and thus be susceptible to infrared detection. Furthermore, a submarine commander, unable to make visual contact with a convoy at night, might not be able to determine with any certainty whether his passive sonar contacts were real ships or decoys designed to emit the acoustic signatures of ships.

Assuming that Chinese submarine commanders do have a good estimation of the convoy's direction, they would then face a choice of strategies. Some captains, prizing the added stealth offered by shallow waters, might choose to intercept at night. In this case, the submarine commander might be forced briefly to come to a shallow depth and use his active surface search radar or sonar to plot his tactical environment and calculate firing solutions. However, active emissions would certainly help enable Taiwanese ASW assets to localize his position. On the other hand, submarine commanders more concerned with remaining undetected might decide to intercept the convoy during the early evening in deeper waters. Yet this strategy would increase the likelihood of detection by long-range passive sonar techniques. In no case, however, would a diesel-electric submarine commander want to track the convoy for an extended period, fearing that he would be detected or that his batteries would be drawn too low before he engaged the enemy.

Generally, Chinese submarines, armed with standard Soviet-designed 533 mm torpedoes, would have to close to within a 12 km firing solution of the convoy in order to attack. However, the Chinese navy's Kilo class may have been outfitted with the latest Russian-built 533 mm passive wake-homing torpedoes that have maximum ranges of 15 km and 25.6 km.⁷⁸ In any event, the submarine commander must not approach the convoy too quickly, because the range of his passive sonar would be degraded by the water rushing past the submarine, thus hindering positive acquisition of the ships in the convoy.

By the time the convoy entered shallow waters, a Taiwanese E-2C would already be on station above it, scanning the ocean surface. Additionally, S-2Ts would be patrolling around the convoy. The S-2T fields the APS-504(V)5 surface search radar, which can potentially detect a periscope, snorkel, or antenna mast from a range of 20–40 km.⁷⁹ Meanwhile, Taiwanese Cheng Kung-class and Knox-class frigates would be listening for acoustic signatures with their passive towed arrays.

⁷⁸ Sharpe, ed., *Jane's Fighting Ships 1996–97*, p. 116; Watts, ed., *Jane's UWS 1996–97*, pp. 194–95.

⁷⁹ Lambert, ed., *Jane's All the World's Aircraft 1991–92*, p. 410; Blake, ed., *Jane's REWS 1992–93*, p. 212; and author's estimate.

However the initial contact were made—by acoustical, exhaust, infrared, visual, or radar signature—an orbiting S-2T would immediately fly to the approximate location of the suspected contact to begin the prosecution. Meanwhile, a S-70C(M)1 would lift off from an escorting Taiwanese frigate to assist the S-2T. The frigate, not wishing to reveal its precise position in such shallow waters, would refrain from any active emissions and assist in the prosecution by listening with its passive towed array and helping to process the acoustic data transmitted by the S-70C(M)1. The S-70C(M)1 is outfitted with the APS-143(V) surface search radar, which can detect a 1 meter² target 37 km distant in relatively rough sea conditions from low altitude. For night operations, both the S-2T and S-70C(M)1 possess infrared sensors.⁸⁰

When the S-2T arrived over the suspected contact, it would begin laying a broad box pattern of probably four rows of four SSQ-41B passive sonobuoys. In the meantime, the operator aboard the S-2T would be adjusting his ARR-84 sonobuoy receiver to segregate the known acoustic frequencies emitted by Chinese submarines. Representing the prevailing generation of ninety-nine-channel sonobuoy receivers, the ARR-84 can receive signals from up to four sonobuoys simultaneously, as well as largely abate both electronic and mechanical interference. Once a contact had been verified and a bearing line to the contact established, further sonobuoys would be deployed along the outward bearing line at regular intervals. Depending on the contact's course, the bearing lines from the subsequent sonobuoys would probably shift. Once a sonobuoy was cast in front of the submarine, the S-2T operator could obtain a bearing reversal on the contact and thus would have a rough fix on the submarine's position. By this time, the contact's approximate course and speed would probably also have been ascertained by analyzing the pattern of the contact's shifting bearing lines. The S-2T would then attempt to further refine the contact's position by dropping a sonobuoy along the submarine's projected course. By using various combinations of three sonobuoys, a contact could gradually be localized into an ever contracting search area.

Meanwhile, the S-70C(M)1 would be fast approaching the contact and either dropping some of its own twenty-five sonobuoys or lowering its AQS-18(V)3 active and passive dipping sonar into the water. The AQS-18(V)3 can detect acoustic signatures at a range of 18.3 km in medium sea states, depending on the characteristics of the sound source and oceanographic conditions, and is integrated with the Adaptive Processor Sonar, which enhances performance in shallow waters and eliminates most false alarms.⁸¹ The data received from the S-70C(M)1's sensors would be downloaded in real time to shipboard operators and processors aboard its frigate.

⁸⁰ See Sharpe, ed., *Jane's Fighting Ships 1996-97*, p. 694; Watts, ed., *Jane's UWS 1996-97*, p. 114; Watts, ed., *Jane's UWS 1995-96*, p. 93; Laur and Llanso, *Encyclopedia of Modern U.S. Military Weapons*, pp. 139-41; Blake, ed., *Jane's REWS 1995-96*, p. 291; and Blake, ed., *Jane's REWS 1992-93*, p. 240.

⁸¹ See Watts, ed., *Jane's UWS 1996-97*, pp. 99, 114; Sharpe, ed., *Jane's Fighting Ships 1996-97*, p. 694; Laur and Llanso, *Encyclopedia of Modern U.S. Military Weapons*, p. 139; and Watts, ed., *Jane's UWS 1992-93*, p. 79.

When the location of the contact had been ascertained with sufficient precision, the S-2T would drop four or more sonobuoys in a line a few hundred meters apart perpendicular to the projected path of the submarine to create an attack barrier. Once the submarine crossed that barrier, ASW operators would have an excellent localization of the contact. Both the S-2T and S-70C(M)1 would trail their ASQ-81(V) magnetic anomaly detectors (MAD) over the submarine's suspected location for a final confirmation. Designed to measure changes in the earth's magnetic field, the ASQ-81(V) MAD can detect large underwater metallic objects. As the S-2T and S-70C(M)1 passed over, a large spike might appear on either aircraft's display. The S-70C(M)1, with a smaller turning radius than that of the S-2T, would immediately swing parallel to the course of the submarine to reach the closest point of approach and release an Mk 46 light-weight torpedo on the target, along with a SSQ-47B active sonobuoy and a smoke marker. Once in the water, the torpedo would begin a helical search pattern with its active homing sonar and, if within 460 meters of a submarine, acquire and attack its target—repeatedly, if its first attack was unsuccessful. With a range of 11 km and a speed of 45 knots, the Mk 46 can outrun any Chinese submarine, nuclear or diesel electric. Unfortunately for Chinese submariners, the countermeasures aboard their boats are limited, like those on the Kilo class, if they have any at all.⁸² And even if the submarine managed to evade the torpedo, the active sonobuoy would already be relaying the submarine's course and range information to Taiwanese ASW platforms for a follow-on attack.

In this manner, the Taiwanese could dispatch the PLAN's old and relatively noisy Romeo-class submarines without inordinate difficulty. Similar in design to the Romeo class, the Ming class would have a marginally better chance of survival. The single-propeller Han and Song classes would be more difficult to detect; however, observers can again recall that American S-3A/Bs outfitted with ASW systems not so dissimilar from those aboard Taiwan's S-2Ts easily tracked a Han-class nuclear attack submarine. Detecting and tracking the Kilo class will present Taiwanese ASW forces with their greatest challenge.

Should the convoy's position be compromised by Chinese forces or enter into an area with particularly poor acoustic reception, Taiwanese commanders could decide to sanitize the area with active sonar. By using active rather than passive sonar, a contact's precise bearing and distance can be ascertained for a rapid localization and attack. However, active sonar propagates nearly ten times farther than its reception range and, therefore, may attract even more Chinese submarines to the convoy. Nonetheless, active sonar may be the best method to ensure the safety of the convoy in certain situations. S-2Ts and S-70C(M)1s would be deployed in the van and on the flanks of the convoy to drop SSQ-47B active sonobuoys in a series of barriers. The escorting frigates, remaining silent, would process the acoustic data from the sonobuoys. Though

⁸² See Watts, ed., *Jane's UWS 1996-97*, pp. 166-67, 202; Sharpe, ed., *Jane's Fighting Ships 1996-97*, pp. 115-17; and Prézelin and Baker, eds., *The Naval Institute Guide*, pp. 88-90.

the irregular ocean floor off Taiwan's southeastern coast would certainly degrade the image that could be produced (with seamounts appearing as suspected contacts), the image could be compared with the oceanographic data collected by the *TaKuan*, enabling the frigate's operators to discriminate reliable suspected contacts from patently unreliable ones. Also, Taiwanese commanders might conduct routine sanitization of choke points where Chinese submarines are likely to lurk or pass through, such as the waters between the islands of the Luzon Strait. Yet sanitized barriers are not impenetrable palisades. Their primary function is to put submarines on the defensive by signaling to them that active ASW assets are near, impel them to evade, and, in doing so, force them to break off any possible attack they might have been conducting. After all, the Taiwanese navy's first mission would be the safe passage of convoys, not the destruction of enemy submarines.

Submarine and antisubmarine warfare are both arduous processes, but ASW is often the more challenging because the attacker ordinarily holds the initiative. He can decide when and where to engage in battle, whereas the ASW operator must expend every tactical effort just to locate his adversary: "By far the greatest problem faced by ASW forces is finding submarines in the first place and tracking them, not sinking them."⁸³ What is certain is that any blockade of Taiwan would have a disruptive impact on the island's economy, as the March 1996 missile tests and military maneuvers demonstrated.⁸⁴

Alternate Strategies

Beijing, however, may not choose to invest Taiwan outright. Instead, it may pursue a course of sabotage, harassment by unarmed fishing boats, military maneuvers, missile tests, or announcements of forthcoming blockades. At the other extreme, Beijing may countenance the detonation of a low-yield nuclear weapon to produce an electromagnetic pulse that disables Taiwan's sophisticated electronic defenses, or launch an assault on one or more of Taiwan's island outposts, such as Quemoy and Matsu. Nevertheless, the use of a nuclear device, however effective against Taiwanese defenses, would likely neutralize China's own more susceptible electronic machinery in Fujian—not to mention spark an international outcry, particularly from Japan and the Philippines. In the latter case, Taiwanese forces may decide prudently to abandon the island outposts after declaring them indefensible, whereupon Beijing would have achieved little at the price of discrediting its own policy of peaceful reunification.⁸⁵

⁸³ Watts, ed., *Jane's UWS 1992-93*, p. 17. See also Jim Shannon, "Undersea Warfare is TEAM Warfare," *Proceedings*, June 1996, pp. 48-49; Bruce Linder, "ASW as Practiced in Birmam Wood," *Proceedings*, May 1996, pp. 62-66.

⁸⁴ "China Maneuvers Hurt Growth in Taiwan," *New York Times*, May 18, 1996.

⁸⁵ See "The Prospects for T-Day," *The Economist*, Sept. 2, 1995, p. 30; Chong-pin Lin, "The Role of the People's Liberation Army in the Process of Reunification: Exploring the Possibilities," in *China's Military: The PLA in 1992/1993*, ed. Richard H. Yang (Boulder, Colo.: Westview Press, 1993), pp. 161-79.

Conclusions

Taiwan remains resolved to resist Beijing's dominion. Meanwhile, Beijing is no less determined to invest Taiwan should it attempt to secede de jure. As reported by the *South China Morning Post* in August 1995, China's chief logistics officer reemphasized Beijing's willingness to use force to maintain Taiwan as a part of China.⁸⁶ In preparation to meet this and other military challenges, Beijing's Central Military Commission

set forth the principle of strengthening the Army's quality building. It is of great significance because it is an important point in [China's] efforts to raise the Army's modernization level and is also a fundamental way of achieving this purpose. Recent local wars, especially the Gulf war, show that the defeated side was backward in modernization and weak in fighting capacity, although there were many other reasons for failure. The times are developing and science and technology are making progress. [China] must quicken [its] pace of modernization in order to keep up with the times and must not slow down.⁸⁷

Accordingly, China has reportedly entered into an agreement with Russia to upgrade its J-8 fighters in Chengdu and establish local production of the Su-27 in Shenyang. Reports still circulate regarding the possible production of seventy-nine MiG-31 fighters in Guizhou Province.⁸⁸ Beijing can be expected to continue to pursue advanced Russian military technologies to enhance its capabilities.

In response, Taiwan must maintain a credible conventional defense against China's increasing absolute power. At this writing, China's relative power with respect to Taiwan is insufficient to ensure battlefield success but is sufficient to threaten Taiwan with the possibility of battlefield defeat. Taipei needs the assistance of the United States and other countries to ensure that this relative balance does not become skewed unequivocally in Beijing's favor. Reunification of Taiwan and China on Beijing's terms would cause a decided shift in the East Asian power balance and give Beijing unimpeded access to the western Pacific. Whether this outcome is fundamentally incompatible with U.S. interests remains an open debate. In the meantime, there appears to be a consensus among American discussants to maintain the status quo across the Taiwan Strait while avoiding a direct Sino-American conflict. Yet there is no other place where Chinese and American forces have come closer to a confrontation since the late 1960s than in the Taiwan Strait. Indeed, some Chinese leaders in Beijing

⁸⁶ See Kathy Chen, "Voices From Both Sides of the Taiwan Strait," *Wall Street Journal*, Feb. 29, 1996; "White Paper' on Taiwan, Refunification [sic] Issued," FBIS, *China*, Sept. 1, 1993, p. 43, from Xinhua News Service, Aug. 31, 1993.

⁸⁷ "Article Views 'In-Depth' Reform of Army," FBIS, *China*, Aug. 27, 1992, p. 33.

⁸⁸ Kahn and Rosett, "China and Russia Rekindle Their Romance"; Kathy Chen and Leslie Chang, "China, Taiwan Vie for Edge in Weapons," *Wall Street Journal*, Feb. 13, 1996; and Nicholas D. Kristof, "The Rise of China," *Foreign Affairs*, Nov./Dec. 1993, p. 66. See also C. Denison Lane, Mark Weisenbloom, and Bimon Liu, *Chinese Military Modernization* (Washington, D.C.: American Enterprise Institute, 1996).

already see the United States as their principal adversary.⁸⁹ With regard to Taiwan, China's Foreign Minister Qian Qichen sternly lectured Americans: "They must not forget that Taiwan is a part of China's territory and is not a protectorate of the United States."⁹⁰

Nonetheless, China cannot be classified as a revolutionary or profoundly disaffected power. In fact, "given the favorable conditions presented by the international economic order, it is still very much in China's self-interest to work within a system from which it has profited so greatly."⁹¹ To the extent that is true, the United States should not alienate China, but try to enmesh it in a complex system of international institutions and regular military, economic, and educational exchanges. That is not to argue that China will be constrained from defending what it considers to be its vital interests by international institutions or exchanges; however, it does give China a greater stake in the prevailing international order.

From a military standpoint, the United States should continue periodically to evaluate Taiwan's defense requirements, sanction the sale of needed weapons systems, and share intelligence with Taiwan, such as the acoustic data of Kilo-class diesel-electric submarines. To maintain stability, U.S. assistance to Taiwan should center on primarily defensive weapons, particularly those dealing with antisubmarine, antimine, and anti-air warfare. Taiwan should be allowed to lease additional Knox-class frigates as they become available as well as purchase further S-2T or S-3A/B ASW aircraft and S-70C(M)1 ASW helicopters, along with SSQ-77A/B passive and SSQ-62C active sonobuoys and OL-320/AYS and AYA-8B acoustic processors. Moreover, Taiwan should be permitted to acquire modern mine-hunting equipment and to improve its air defenses with advanced air search radars, C³ automation, E-2D AEW aircraft, and F404-GE-400 or F414-GE-400 engines for its Ching-kuo fighters.

Symmetric relative capabilities alone, however, do not offer a neat, definitive solution to Taiwan's enduring insecurity since other dangers may arise if Taiwan appears to be too militarily strong. The United States may decide that it no longer needs to participate actively in Taiwan's defense, or the Taiwanese

⁸⁹ See Patrick E. Tyler, "China Warns U.S. to Keep Away From Taiwan Strait," *New York Times*, Mar. 18, 1996; "U.S. Dismisses Chinese Warning," *New York Times*, Mar. 18, 1996; Marcus W. Brauchli, "China-Taiwan Flap Worries Neighbors," *Wall Street Journal*, Mar. 12, 1996; Patrick E. Tyler, "As China Threatens Taiwan, It Makes Sure U.S. Listens," *New York Times*, Jan. 24, 1996; Kenneth Lieberthal, "A New China Strategy," *Foreign Affairs*, Nov./Dec. 1995, pp. 35-49; Seth Faison, "Beijing Sees U.S. Moves As Plot to Thwart China," *New York Times*, Aug. 5, 1995; Joseph S. Nye Jr., "The Case for Deep Engagement," *Foreign Affairs*, July/Aug. 1995, pp. 90-102; Chalmers Johnson and E.B. Keehn, "The Pentagon's Ossified Strategy," *Foreign Affairs*, July/Aug. 1995, pp. 103-14; Patrick E. Tyler, "Chinese Military Sees U.S. as a Foe," *New York Times*, Nov. 16, 1993; and Lena Sun, "China's Party Sees a Threat From the West," *Washington Post*, Nov. 12, 1991. See also James A. Winnefeld et al., *A New Strategy and Fewer Forces: The Pacific Dimension* (Santa Monica, Calif: RAND, 1992).

⁹⁰ Tyler, "China Warns U.S. to Keep Away From Taiwan Strait."

⁹¹ Karl W. Eikenberry, "Does China Threaten Asia-Pacific Regional Stability?" *Parameters*, Spring 1995, p. 96. See also Gerald Segal, "East Asia and the 'Constraint' of China," *International Security*, Spring 1996, pp. 107-35.

themselves may grow overconfident in their enthusiasm for independence, thereby precipitating a Chinese descent. It is indeed difficult to foretell what will transpire in East Asia ten or fifteen years from this writing when Chinese conventional force modernization is projected to be largely complete. At present, Beijing is constrained from action by conflicting internal exigencies and external deterrents, not the least of which are the unseen consequences of taking Taiwan by force.

