Strangulation from the Sea?

A PRC Submarine Blockade of Taiwan

Michael A. Glosny

The rise of the People's Republic of China (PRC) is one of the most important challenges for U.S. foreign policy.[1] Although many scholars judge current U.S.-China relations to be at their best in many years, President Chen Shui-bian's moves toward gradual independence before Taiwan's March 2004 presidential election, which were met by warnings and threats from the mainland, are a reminder that the Taiwan issue remains a potential source of instability.[2] Further moves toward Taiwan's independence during President Chen's second term, such as rewriting the constitution, may very well lead to another Taiwan Strait crisis. The military buildup of the People's Liberation Army (PLA), which is largely focused on Taiwan, combined with the island's disputed political status, make a PRC attack on Taiwan one of the most likely short-to-medium-term (next five to ten years) threats to East Asian stability, and therefore U.S. economic and security interests.[3] Could the PRC successfully use military force to settle the Taiwan issue?

Scholarly debates about Chinese intentions and overall strategic goals in East Asia rarely address the prospects for a successful Chinese use of force

Michael A. Glosny is a doctoral candidate in political science at the Massachusetts Institute of Technology and a member of MIT's Security Studies Program.

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1. See Rear Adm. Michael McDevitt, U.S. Navy (ret.), "The QDR and East Asia," *U.S. Naval Institute Proceedings* (hereafter *Proceedings*), Vol. 128 (March 2002), pp. 87–88.
2. For assessments of the improvement in U.S.-China relations, see Thomas J. Christensen and Michael A. Glosny, "China: Sources of Stability in U.S.-China Security Relations," in Richard J. Ellings and Aaron L. Friedberg with Michael Wills, eds., *Strategic Asia, 2003–04: Fragility and Crisis* (Seattle, Wash.: National Bureau of Asian Research, 2003), pp. 53–79; and David M. Lampton, "The Stealth Normalization of U.S.-China Relations," *National Interest,* Vol. 73 (Fall 2003), pp. 37–48. For a description of Taiwan's recent moves toward independence, see Chang Yun-ping, "Chen Drafts Timetable on Constitution," *Taipei Times,* November 12, 2003; and Kathrin Hille, "Taiwan Defends Plans for Referendum," *Financial Times,* December 10, 2003. For reports of PRC warnings and threats, see John Pomfret, "China's Military Warns Taiwan," *Washington Post,* December 4, 2003.
3. See U.S. Department of Defense, 2003 *Annual Report on the Military Power of the People's Republic of China, Report to Congress Pursuant to the FY 2000 National Defense Authorization Act,* July 28, 2003, http://www.defenselink.mil/pubs/20030730chinaex.pdf.

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against Taiwan.[4] Although there has been much research on the PLA and the cross-strait military balance, these works usually do not provide an analysis and evaluation of a China-Taiwan force encounter.[5] To assess the prospects for a successful use of force, one needs to analyze a particular tactic or combination of tactics that China might use and Taiwan's potential responses.

Although two recent analyses suggest that a PLA amphibious invasion would be unlikely to succeed before 2010, they also suggest that in the short to medium term, the PRC is more likely to attempt to coerce Taiwan than it is to launch an invasion.[6] Without sufficient military capability to conquer Taiwan, the PRC would have to rely on inflicting enough damage to force capitulation.[7] The PLA's recent modernization efforts seem to focus on developing coercive

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4. According to "China threat" arguments, as China's economic and military power continue to grow, the PRC will seek to dominate East Asia and displace U.S. influence and power from the region. See Richard Bernstein and Ross H. Munro, "China I: The Coming Conflict with America," *Foreign Affairs,* Vol. 76, No. 2 (March/April 1997), pp. 18–31; Richard Bernstein and Ross H. Munro, *The Coming Conflict with China* (New York: Knopf, 1997); and Bill Gertz, *The China Threat: How the People's Republic Targets America* (Washington, D.C.: Regnery, 2000). For arguments that China's external behavior is driven by internal insecurity, fears of invasion, concerns over legitimacy, and a history of humiliation, see Robert S. Ross and Andrew J. Nathan, *The Great Wall and the Empty Fortress: China's Search for Security* (New York: W.W. Norton, 1997). For a response to Bernstein and Munro, see Robert S. Ross, "China II: Beijing as a Conservative Power," *Foreign Affairs,* Vol. 76, No. 2 (March/April 1997), pp. 33–44. For an exploration of the evidence for and against the characterization of China as a revisionist power, see Alastair Iain Johnston, "Is China a Status Quo Power?" *International Security,* Vol. 27, No. 4 (Spring 2003), pp. 5–56. A Chinese use of force against Taiwan, however, may be consistent with aggressive or defensive intentions.

5. For works on the PLA, see David Shambaugh, *Modernizing China's Military: Progress, Problems, and Prospects* (Berkeley: University of California Press, 2002); Larry Wortzel, ed., *The Chinese Armed Forces in the 21st Century* (Carlisle Barracks, Pa.: Strategic Studies Institute, U.S. Army War College, 2000); and James C. Mulvenon and Richard H. Yang, eds., *The People's Liberation Army in the Information Age* (Santa Monica, Calif.: RAND, 2000). For pessimistic analyses of the cross-strait military balance, see Bernstein and Munro, "China I"; Bernstein and Munro, *The Coming Conflict with China;* Gertz, *The China Threat;* David Shambaugh, "A Matter of Time: Taiwan's Eroding Military Advantage," *Washington Quarterly,* Vol. 23, No. 2 (Spring 2000), pp. 119–133; and James Lilley and Carl Ford, "China's Military: A Second Opinion," *National Interest,* Vol. 57 (Fall 1999), pp. 71–77. For more optimistic assessments of the cross-strait military balance, see Bates Gill and Michael O'Hanlon, "China's Hollow Military," *National Interest,* Vol. 56 (Summer 1999), pp. 55–62; and Ivan Eland, "Is Chinese Military Modernization a Threat to the United States?" *Policy Analysis,* January 23, 2003.

6. See Michael O'Hanlon, "Why China Cannot Conquer Taiwan," *International Security,* Vol. 25, No. 2 (Fall 2000), especially p. 53; and David A. Shlapak, David T. Orletsky, and Barry A. Wilson, *Dire Strait? Military Aspects of the China-Taiwan Confrontation and Options for U.S. Policy* (Santa Monica, Calif.: RAND, 2000), especially p. xii.

7. For work on coercion, see Thomas C. Schelling, *Arms and Influence* (New Haven, Conn.: Yale University Press, 1966); Robert J. Art, "To What Ends Military Power?" *International Security,* Vol. 4, No. 4 (Spring 1980), pp. 3–35; and Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, N.Y.: Cornell University Press, 1996). Following Pape, p. 4, my use of the term "coercion" is similar to Schelling's concept of compellence. Therefore, coercion is the use of force to get another actor to change its behavior.

capabilities.[8] The two most widely discussed coercive strategies are the use of short-range ballistic missiles and submarines.[9] This article focuses on the coercive use of submarines against Taiwanese shipping.[10]

Several recent books by PLA officers discuss a submarine blockade as a potential force option.[11] The PLA is also directing much of its force modernization on advanced submarine procurement and training.[12] Moreover, the use of submarines to blockade Taiwan would be relatively easy and would not require development of significant power projection capabilities. According to conventional wisdom in the United States, a submarine blockade could represent a real threat to Taiwan's security.[13]

This article assesses the prospects for a successful coercive submarine blockade of Taiwanese ports.[14] Judging success in a coercive campaign requires both an analysis of the effect of military capabilities and an analysis of Taiwan's

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8. See U.S. Department of Defense, 2003 *Annual Report on the Military Power of the People's Republic of China.* For a discussion of some of the strategies that the Chinese are considering, see Thomas J. Christensen, "Posing Problems without Catching Up: China's Rise and Challenges to U.S. Security Policy," *International Security,* Vol. 25, No. 4 (Spring 2001), pp. 5–40.
9. For work on PLA missiles, see Mark A. Stokes, *China's Strategic Modernization: Implications for the United States* (Carlisle Barracks, Pa.: Strategic Studies Institute, U.S. Army War College, 1999).
10. The two are obviously not mutually exclusive. Moreover, the discussion later in this article about whether Taiwan would stand firm or capitulate would also be important in trying to judge the success of any coercive use of missiles.
11. See Wang Houqing and Zhang Xingye, eds., *Zhanyi Xue* [The science of campaigns] (Beijing: National Defense University Press, May 2000), pp. 320–324, 407–421; Li Mingliang, *Fengsuo yu Fan Fengsuo Zuozhan* [Blockade and antiblockade warfare] (Beijing: Military Sciences Press, 2001); and Hu Wenlong, chief ed., *Lianhe Fengsuo Zuozhan Yanjiu* [Research on joint blockade operations] (Beijing: Military Sciences Press, 1999).
12. See U.S. Department of Defense, 2003 *Annual Report on the Military Power of the People's Republic of China;* Bernard Cole, *The Great Wall at Sea: China's Navy Enters the Twenty-first Century* (Annapolis: Naval Institute Press, 2001); Lyle Goldstein and William Murray, "Undersea Dragons: China's Maturing Submarine Force," *International Security,* Vol. 28, No. 4 (Spring 2004), pp. 161–196; Kenneth W. Allen, *PLA Navy Building at the Start of a New Century,* report from the Second Conference on the PLA Navy, June 28–29, 2001 (Alexandria, Va.: CNA, 2001); Michael McDevitt, "Where Is China's Navy Headed?" *Proceedings,* Vol. 127 (May 2001), pp. 58–61; and John Pomfret, "China to Buy 8 More Russian Submarines," *Washington Post,* June 25, 2002.
13. For statements expressing concern over a potential blockade, see U.S. Department of Defense, 2003 *Annual Report on the Military Power of the People's Republic of China;* U.S. Department of Defense, "The Security Situation in the Taiwan Strait," February 1999, especially pp. 14–16; Michael O'Hanlon, *Budget Options for the Bush Administration* (Washington, D.C.: Brookings, 2001), p. 225; and Chris Cockel, "Peace in Taiwan Strait Not a Given, Says U.S. Official," *China Post,* April 5, 2002.
14. Analysts are only at the nascent stages of understanding PLA doctrine and organization at the operational level. Although the PLA may run a blockade differently at the tactical or operational level than this article describes, this analysis is a best attempt to evaluate how successful a blockade might be. See the conference papers "The PLA Revolution in Doctrinal Affairs," RAND-CNA, December 5–8, 2002.

political will. The military analysis seeks to determine how much damage a Chinese submarine blockade could do to the Taiwanese economy. It considers scenarios using torpedoes and those using sea mines. The military analysis employs relatively simple models, based on optimistic and pessimistic assumptions, to determine a plausible range of military damage. The political analysis seeks to evaluate whether the amount of damage inflicted by the submarines would likely be enough to force Taiwan to capitulate. This analysis does not include U.S. military involvement in countering the blockade, though it does include U.S. nonmilitary support. Examining Taiwan's self-defense capability, under conditions of limited U.S. assistance, represents a hard test.

The central finding of this analysis is that although a PRC submarine blockade could impose costs on Taiwan, the threat of a successful blockade is overstated. Even using assumptions very favorable to the PLA Navy (PLAN), a blockade would likely inflict only limited damage on Taiwan. Unless this damage was sufficient to force Taiwan to collapse quickly, a PRC submarine blockade would most likely not be successful. Moreover, there are good reasons to suggest that when confronted by such an attack, Taiwan would stand firm in response.

The following section discusses the advantages of a PRC submarine blockade of Taiwan and the political demands that would accompany it. The second section describes Taiwan's economic and geographic vulnerabilities. The third and fourth sections develop the torpedo and mine simulations. The fifth section compares the results of these simulations with historical examples. The sixth section examines cases for Taiwan capitulating versus standing firm. The final section offers several conclusions based on the analysis and suggests lessons of the analysis for arms sales, cross-strait deterrence, and PLAN submarine modernization.

Blockade As a Use of Force

In this analysis, the PRC leadership has decided that the current situation and future trends across the Taiwan Strait threaten regime survival, and therefore it "has no other choice" but to use force.[15] Rather than engaging in a show of

15. For analysis of likely conditions under which the PRC might decide to use force, see Steven M. Goldstein, "The Taiwan Strait: A Continuing Status Quo of Deadlock," *Cambridge Review of International Affairs,* Vol. 15, No. 1 (April 2002), pp. 85–94; and Christensen, "Posing Problems without Catching Up." For an argument that cross-strait relations should remain stable, see Robert S. Ross, "Navigating the Taiwan Strait: Deterrence, Escalation Dominance, and U.S.-China Relations," *International Security,* Vol. 27, No. 2 (Fall 2002), pp. 48–85.

force simply to signal its resolve on the Taiwan issue again, the PRC leadership has chosen to use significant military force to coerce Taiwan. The discussion below assesses the amount of damage the PRC would be able to inflict in a six-month period.[16] Beijing would accompany its military action with a demand that Taipei agree to reunification under the "one country, two systems" formula, which would allow Taiwan to maintain considerable autonomy.[17]

A submarine blockade would use China's advantages to exploit Taiwanese military and economic vulnerabilities. In the short term, a blockade could produce economic shock and a siege mentality sufficient to force capitulation.[18] In the medium term, it would harm trade, reducing the import of key raw materials and the export of finished goods. As the damage mounted, the prospect of continued hardship could pressure the Taiwanese to capitulate. Many Chinese analysts recognize these advantages and weaknesses, and some express confidence regarding the success of a submarine blockade.[19]

Economics and Geography of Taiwanese Ports

Economically and geographically, Taiwan is vulnerable to a Chinese blockade. Although having recently experienced an economic recession, it is still one of the most advanced economies in East Asia. Because it is an island, Taiwan is highly dependent on trade, relying on imports for more than 80–90 percent of

16. For an analysis assuming a three-month duration, see Paul H.B. Godwin, "The Use of Military Force against Taiwan: Potential PRC Scenarios," in Parris H. Chang and Martin L. Lasater, eds., *If China Crosses the Taiwan Straits: The International Response* (New York: University Press of America, 1993), p. 17. If Taiwan has not capitulated by this point, the PRC would probably be forced to escalate or back down. It is also possible to imagine the PRC declaring victory after six months, claiming it had taught Taiwan a lesson, even if Taipei had not given in to Beijing's demands. However, this would still count as a coercive failure. Moreover, Taiwan's stated policy is to respond to a PRC use of force with a formal declaration of independence.

17. For a similar political scenario, see ibid. For an explanation of this formula, see "PRC: Qian Qichen Proposes '7-Point' Plan for '1 Country, 2 Systems' in Taiwan," *Wen Wei Po,* July 13, 2001, Foreign Broadcast Information Service (FBIS) CPP20010713000050. Under this plan Taiwan would keep its military and its currency and maintain its existing government framework; in addition, the mainland would not send officials to Taiwan.

18. See John Garver, *Face Off: China, the United States, and Taiwan's Democratization* (Seattle: University of Washington Press, 1997), p. 118; and "Military Publication Warns Taiwan," *Zhongguo Guofang Bao,* July 23, 1999, FBIS OW0608092499.

19. See "PRC Taiwan Expert Disparages Taiwan Military Capability," *Ta Kung Pao,* September 19, 2000, FBIS CPP20000919000039; "Jiefangjun Bao Views Developments, Problems in Taiwan Armed Forces," *Jiefangjun Bao,* May 30, 2001, FBIS CPP20010530000078; "Blockade Said First Option against Taiwan," *Ta Kung Pao,* September 10, 1999, FBIS OW1009084999; and "PRC, Taiwan Submarine, Antisubmarine Capabilities Compared," *Kuang Chiao Ching,* August 16, 2002, FBIS CPP20020816000067. Many of my mainland interlocutors, if not optimistic about success, at least pointed to some of the above-mentioned weaknesses that a blockade could exploit.

its food and most of its oil.[20] In the early 1990s, Taiwan maintained a one-year stockpile of oil, but by the summer of 2002, its reserves had dropped to approximately one month.[21] Taiwan also relies heavily on exports to fuel its economic growth. With competition in East Asia and Southeast Asia, Taiwan is dependent on competitively priced exports, so if production costs are forced to increase, buyers may import products from other countries.

Taiwan is located approximately 160 kilometers (100 miles) off of the east coast of the Chinese province of Fujian.[22] Three Taiwanese ports—Keelung (in the north), Taichung (in the west), and Kaohsiung (in the south)—handle approximately 90 percent of all shipping entering and exiting Taiwan, including most of the island's imported food and oil. For this reason, they are the most likely targets of a Chinese blockade.[23] For these three ports, the total traffic for six months is approximately 30,000 merchant vessels.[24] In the remainder of this article, I refer to this figure as "Taiwanese shipping."[25]

The waters off these ports are very shallow, which would complicate Taiwanese antisubmarine warfare (ASW) operations.[26] This complex and variable underwater environment creates unfavorable sound propagation qualities, which can degrade sonar detection of submarines or mines. The high level of ambient noise in shallow water also produces many false contacts, especially if one relies on passive sonar, thus making the search for enemy submarines frustratingly slow.[27] When German submarines with snorkels operated in the shal-

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20. See Gary Klintworth, "China and Taiwan—From Flashpoint to Redefining One China," November 7, 2000, p. 16, http://www.aph.gov.au/library/pubs/rp/2000–01/01rp15.htm.
21. See "Taiwan's CPC Raises Oil Security Reserves amid Escalating Middle East Tensions," Taipei Central News Agency, September 4, 2002, FBIS CPP20020904000099. My interlocutors in the Taiwanese navy estimated the oil reserves to be about three to four weeks in the summer of 2002.
22. For a description of Taiwan's geography, see http://www.fas.org/man/dod-101/ops/taiwan-geo.htm.
23. Felix K. Chang also includes the eastern ports of Suao and Hualien in his analysis. See Chang, "Conventional War across the Taiwan Strait," *Orbis,* Vol. 40, No. 4 (Fall 1996), p. 600. Although including only the three main ports in his analysis, Godwin suggests that the Taiwanese might want to transfer some cargo to these smaller eastern ports. See Godwin, "The Use of Military Force against Taiwan," p. 22. My interlocutors at the Kaohsiung and Keelung harbor bureaus, however, suggested that the eastern ports were so crowded that they could not handle much more cargo and had little capacity to handle oil tankers. For a description of the cargo capacity of these ports, see *Lloyd's Ports of the World: 2002* (Colchester, Essex, U.K.: Lloyd's of London Press, 2002).
24. For the specific statistics, see http://www.klhb.gov.tw; http://www.tchb.gov.tw; and http://www.khb.gov.tw.
25. By this I do not mean only ships in Taiwan's merchant marine, but all merchant ships that enter or depart from Taiwan's ports, regardless of the flag they carry.
26. See Joseph Morgan and Mark J. Valencia, eds., *Atlas for Marine Policy in East Asian Seas* (Berkeley: University of California Press, 1992). To reach Kaohsiung and Taichung, merchant ships must enter the shallow water of the Taiwan Strait. To reach Keelung, merchant ships must enter the shallow water off Taiwan's east coast.
27. For more discussion of the difficulties of ASW in the shallow waters surrounding Taiwan, see

low waters off the coast of Britain in World War II, for example, Allied ASW efforts experienced similar difficulties and required a disproportionate number of assets to defeat the threat.[28] PLAN submariners train in these waters and are used to operating in them, despite the challenges that shallow water presents for maneuver and attack. As for mining scenarios, officers in the U.S. Navy and Taiwanese navy have suggested that these ports are susceptible to mines.[29] Shallow water would allow the PLAN to more effectively use bottom mines, which may become hidden on the sea floor, making them difficult to find and destroy. The difficult sonar conditions would also complicate detection of mines.

Torpedo Scenarios

This section analyzes a PLAN attempt to use its submarines to patrol areas off the ports of Keelung, Taichung, and Kaohsiung and attack merchant ships with torpedoes. First, it describes the scenarios. Then, it lists the assets that the PRC and Taiwan would employ in these scenarios. Next, it discusses the parameters and variables used to produce a range of possible damage. Finally, it presents the results of the analysis and a discussion of the lessons.

CHINESE SUBMARINE TACTICS

This analysis assumes that the Chinese submarines patrol areas near Taiwanese ports, hoping to attack merchant ship targets after they have broken away from international shipping lanes or before they join them. This would simplify the submarine's search for merchant ships and would ensure that it does

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Shlapak, Orletsky, and Wilson, *Dire Strait?* p. 22. For a brief introduction to ASW, see J.R. Hill, *Anti-Submarine Warfare,* 2d ed. (Annapolis: Naval Institute Press, 1984). For an introduction to ocean acoustics, see Albert W. Cox, *Sonar and Underwater Sound* (Lexington, Mass.: Lexington Books, 1974), especially p. 39. For discussions of the threat of diesel submarines in the acoustically challenging shallows, see Keith Edmunds, "ASW—Current and Future Trends," *Defense Analysis,* Vol. 16, No. 1 (April 2000), pp. 73–87; Norman Friedman, "Littoral Anti-Submarine Warfare—Not as Easy as It Sounds," *International Defense Review,* June 1995, pp. 53–57; Brian Longworth, "Solutions to the Shallow-Water Challenge," *Jane's Navy International,* Vol. 101, No. 5 (June 1996), pp. 10–18; and Tim Sloth Joergensen, "U.S. Navy Operations in Littoral Waters: 2000 and Beyond," *Naval War College Review,* Vol. 51, No. 2 (Spring 1998), pp. 20–29.

28. See Sir Arthur Richard Hezlet, *The Submarine and Seapower* (London: P. Davies, 1967); S.W. Roskill, *The War at Sea, 1939–1945,* Vols. 1–3 (London: Her Majesty's Stationery Office, 1954–60); D.M. Sternhill and A.M. Thorndike, *Antisubmarine Warfare in World War II,* Report No. 51 (Washington, D.C.: Operations Evaluation Group, 1946); and Clay Blair, *Hitler's U-Boat War,* Vols. 1–2 (New York: Modern Library, 2000). The British also encountered similar difficulties in searching for Argentinean submarines in the 1982 Falklands War.

29. Interviews, Taipei, summer 2001 and summer 2002; and Washington, D.C., fall 2002 and summer 2003.

not mistakenly attack a ship heading to or coming from another country, which could be considered a declaration of war on all shipping in the Pacific Ocean. Once the Chinese submarine captain believes that he has made contact, he will most likely go up to periscope depth for confirmation, engage, and then attempt to escape.

READINESS RATES

This analysis assumes the PLAN would use all of its available submarines against Taiwan, leaving itself very vulnerable in other strategic areas.[30] (Table 1 lists the assets that China and Taiwan would likely employ in a submarine blockade.) Of the sixty-three available submarines, however, not all would be fully operational and ready to deploy. The PLAN's Romeos are some of the oldest diesel submarines in operation in the world, dating from the 1950s to the 1970s. Its Mings are more advanced versions of the Romeos, but an April 2003 submarine disaster caused by mechanical failure during an attempt to submerge in a simple exercise suggests that there may be problems with the basic operations of the engines or batteries of submarines in this class.[31] The Song represents China's first attempt to indigenously produce a modern diesel-electric submarine. Disappointed with the quality and reliability of the Song after the first hull completed trials, the PLAN restarted its Ming program. Shortly after the second hull completed trials, the PRC decided to purchase eight more Kilos from Russia.[32] This may suggest that the Chinese are not satisfied with the progress of the Song. On two separate occasions, in 1998 and 2000, at least two of China's four modern Kilos were taken out of operation due to technical problems and were sent back to Russia. With the PLAN's cutting of maintenance costs and faulty maintenance procedures contributing to these problems, it is reasonable to somewhat discount the readiness of Chinese submarines.[33]

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30. The PLAN is divided into three fleets. The North Fleet is directed against Japan and Korea, the East Fleet is responsible for Taiwan, and the South Fleet is responsible for the South China Sea. See Cole, *The Great Wall at Sea*, chap. 4.
31. See Indira A.R. Lakshmanan, "Cause of Submarine Disaster Is Mystery," *Boston Globe*, May 4, 2003. This accident killed all seventy crew members.
32. Pomfret, "China to Buy 8 More Russian Submarines"; and Nikolai Novichkov, "China's Russian Kilo Buy May Put Song Submarine Future in Doubt," *Jane's Defence Weekly*, June 12, 2002.
33. For the troubles in 1998, see "Two of China's 'Kilos' Are No Longer in Operation," *Jane's Defence Weekly*, September 2, 1998; Robert Sae-Liu, "Second Song Submarine Vital to China's Huge Programme," *Jane's Defence Weekly*, August 18, 1999; and "New PLAN to Train, Purchase Vessel Mix," *Jane's Defence Weekly*, December 16, 1998. For the troubles in 2000, see Samuel Loring Morison, "Chinese Navy Orders Eight Kilo-Class Submarines," *Navy News Week*, June 24, 2002;

Table 1. China and Taiwan Balance of Forces.

PRC Submarine Force	Taiwan's ASW Assets	Taiwan's MCM Assets
32 Romeos	26 S-2s (land-based patrol craft)	4 ex-Aggressive minesweepers
19 Mings	10 ex-Gearing destroyers	4 ex-Adjutant coastal minesweepers
3 Songs	21 frigates (7 Perry class, 6 LaFayette class, 8 Knox class)	4 MWV 50-class coastal mine hunters
4 Kilo class (2 of the 877 export variant, 2 of the 636 improved)	33 ASW helicopters (12 MD-500, 21 S-70C[M]1/2)	
5 Han-class nuclear submarines		
Total: 63 submarines		

SOURCES: International Institute for Strategic Studies, *Military Balance, 2003–2004* (New York: Oxford University Press, 2003); A.D. Baker III, ed., *Combat Fleets of the World, 2002–2003: Their Ships, Aircraft, and Systems* (Annapolis: Naval Institute Press, 2002); and Stephen Saunders, ed., *Jane's Fighting Ships, 2003–2004* (Alexandria, Va.: Jane's Information Group, 2003).

The analysis includes two measures of PLAN submarine readiness.[34] An optimistic assessment assumes that thirty-three out of sixty-three submarines are operational, or slightly more than 50 percent of the submarine fleet.[35] A more pessimistic assessment assumes that fifty-one out of sixty-three submarines are operational, or approximately 80 percent. Given the number of extremely old submarines in the Chinese inventory and the PLAN's poor maintenance procedures, these estimates are very favorable to the Chinese. For comparison, the U.S. Department of Defense estimated that a more modern and capable Soviet submarine fleet could maintain only a 50 percent readiness

and "Taiwan Report Says China Has 'Big Problems' with Russian-Made Submarines," *Taipei Times,* July 2, 2002, FBIS CPP20020702000150.

34. For an estimate of a 30 percent readiness rate, see Klintworth, "China and Taiwan—From Flashpoint to Redefining One China," p. 28. In a 2005 scenario, one study estimates that twenty-four submarines would be operational, including only three Romeos and four Mings. See Shlapak, Orletsky, and Wilson, *Dire Strait?* pp. 21–22. For the assumption that 80 percent of PRC submarines would be operational, see Chang, "Conventional War across the Taiwan Strait."

35. Optimistic and pessimistic are relative to the United States and its potential defense commitment. An optimistic assessment, from the U.S. and Taiwanese perspective, is one in which the PLAN has fewer submarines; a pessimistic assessment would be one in which the PLAN had more submarines.

rate during the Cold War.[36] Moreover, assuming that the PLAN submarine fleet would be able to sustain operations without significant breakdowns or slowdowns is again very favorable to the PRC.

CYCLE TIMES

The cycle time is the total transit time to and from station (near Taiwan's ports), including the time on patrol.[37] The Chinese have shorter transit times, no choke points to traverse, a smaller search area for potential targets, and better sonar systems than the Germans in World War II, all of which suggests a shorter cycle time.[38] I therefore use a two-week and a three-week cycle time to produce a range of outcomes.[39] The assumption that the PLAN can sustain such cycle times over a period of six months strongly favors the Chinese.[40]

SUBMARINE DEPLOYMENT PER CYCLE

This measures the number of submarines that are deployed for each cycle time. Germany in World War II was often able to keep two-thirds of its submarines at sea.[41] However, with older submarines and less experience in maintenance procedures, the Chinese would likely not be able to keep as many submarines deployed as did the Germans. To produce a range of results, I run each simulation with a one-third deployed per cycle and a one-half rate.

PROBABILITY OF FINDING AND ATTACKING MERCHANT SHIPS

In the 100 percent finding assumption, I assume that each submarine that sorties will find enough targets, successfully move into position to engage,

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36. See U.S. Department of Defense, *Soviet Military Power, 1987,* p. 96. For more on the poor maintenance procedures of the Chinese, see Cole, *The Great Wall at Sea;* "Two of China's 'Kilos' Are No Longer in Operation"; Sae-Liu, "Second Song Submarine Vital to China's Huge Programme"; "New PLAN to Train, Purchase Vessel Mix"; Morison, "Chinese Navy Orders Eight Kilo-Class Submarines"; and "Taiwan Report Says China Has 'Big Problems' with Russian-Made Submarines."

37. On average, each submarine has to travel approximately 700 kilometers to transit from fleet headquarters to the port. Traveling at 10 knots, each leg should take thirty-seven hours, with the round-trip transit requiring about three days. Rather than returning to its original base, each submarine should be able to return to the East Fleet headquarters for routine maintenance, refitting, and reprovisioning, further reducing the transit time.

38. In the Battle of the Atlantic, the cycle times for submarines patrolling the North Atlantic were usually one to two months, while those patrolling off the east coast of the United States were usually two to three months. See Blair, *Hitler's U-Boat War,* Vols. 1–2.

39. My interlocutors in the Taiwanese navy use two-, three-, and four-week cycle times for planning estimates.

40. For evidence of Chinese thinking on how to sustain submarine operations in wartime, see "PRC Submarine Unit Has First Success in Using Civilian Port to Load Torpedoes," *Zhongguo Qingnian Bao,* June 1, 2002, FBIS CPP20020603000058.

41. See Peter Kemp, *Decision at Sea: The Convoy Escorts* (New York: E.P. Dutton, 1978), p. 88.

and feel "safe" enough to launch all of its torpedoes within the cycle time. Experience from World War II shows that U.S. submarines in the Pacific and German submarines in the Atlantic often returned home from patrols with unfired torpedoes. The 100 percent finding assumption gives the PLAN credit for being very aggressive, efficient, and lucky.[42] This is an especially favorable assumption for PLAN submariners, whose tactical proficiency many analysts question.[43]

TORPEDO PROBABILITY OF KILL (PK)

For each torpedo fired, the pk provides an estimate for the chance of destroying its target.[44] Experience from World War II provides a range of torpedo pks for sustained blockade operations.[45] With more advanced submarines and underwater weapons, it may seem reasonable to assume higher torpedo pks, and some analysts do.[46] The acoustically challenging shallow waters around Taiwan, however, would degrade the effectiveness of a homing torpedo.[47] Increases in the speed and the size of merchant ships may also suggest a lower pk. Given this evidence, and considering the overall low quality of PLAN training, a pk of 0.25 for Chinese torpedoes seems reasonable, and perhaps even favorable to the Chinese.

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42. See Clay Blair Jr., *Silent Victory: The U.S. Submarine War against Japan,* Vol. 2 (Philadelphia: J.B. Lippincott, 1975), pp. 863–968; and Blair, *Hitler's U-Boat War,* Vols. 1–2, especially appendixes. PLAN knowledge of the shipping lanes and ability to patrol near the ports should ease the search for merchant ships somewhat, but this is still a very favorable assumption.
43. See McDevitt, "Where Is China's Navy Headed?"; and Brad Kaplan, "China's Navy Today: Storm Clouds on the Horizon . . . or Paper Tiger?" *Sea Power,* December 1999, p. 31. Moreover, moving into attack position would also be difficult for submarines, especially if the merchant ships attempted to stay near the coastline as much as possible.
44. The pk is defined as: "The statistical probability that the weapon will detonate close enough to the target with enough effectiveness to disable the target." See http://www.fas.org/news/reference/lexicon/dep.htm.
45. U.S. submarines in World War II required ten torpedoes for each kill (pk = 0.1). See Blair, *Silent Victory,* p. 793. In the Atlantic convoy battles of March 1943, out of eighty-five torpedoes fired against merchant ships, twenty-two merchant ships were destroyed (pk = 0.26). See Jurgen Rowher, *The Critical Convoy Battles of March 1943* (Annapolis: Naval Institute Press, 1977), pp. 197–200. In an analysis of a hypothetical Soviet blockade against NATO, one analyst uses a torpedo pk of 0.25, consistent with the most devastating German attacks. See Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, N.Y.: Cornell Press, 1992), p. 182.
46. In a Soviet blockade scenario, although assigning a torpedo pk of 0.5, in recognition that this may be high, one analyst artificially limits the number of shots that a submarine can fire in each engagement. See Christopher C. Wright, "Developing Maritime Force Structure Options for the U.S. Defense Program," master's thesis, Massachusetts Institute of Technology, 1976, chap. 3. For a range of barrier pks from 0.1 to 0.5 in a Soviet blockade scenario, with 0.25 as the base case, see Paul H. Nitze and Leonard Sullivan, *Securing the Seas: The Soviet Naval Challenge and Western Alliance Options* (Boulder, Colo.: Westview, 1979), chap. 13.
47. For examples of torpedo failures in the Falklands War, see David Miller and John Jordan, *Modern Submarine Warfare* (New York: Salamander, 1987), p. 75.

SIMULATION 1

This simulation is a best-case scenario for the Chinese. In it, Taiwan allows entering and exiting merchant ships to sail independently, relying on increased speed for protection. Each PLAN submarine launches all sixteen of its torpedoes per cycle, resulting in four kills.[48] The parameters used in this simulation, to produce a range of outcomes, are number of operational submarines (thirty-three and fifty-one), cycle time (two-week and three-week), and deployment rate per cycle (one-third and one-half). For the target set, I assume a steady rate for merchant ships entering and exiting Taiwanese ports per cycle, which is 30,000 for the six-month period, 2,500 ships for each two-week cycle, and 3,750 for each three-week cycle. Simulation 1, with varying sensitivities, shows the range of damage that PLAN submarines could inflict on merchant ships when conditions are favorable for the Chinese and there is minimal Taiwanese resistance.

SIMULATION 2

Simulation 2 illustrates a more realistic scenario, in which Taiwan organizes two ASW barriers—land-based patrol aircraft (S-2s) and convoy escorts (mostly frigates).[49] A submarine would need to traverse each of the ASW barriers once before attacking, and then once more on the return transit, to survive the cycle. Analysis from a potential NATO–Warsaw Pact ASW barrier operation suggests plausible pks ranging from 0.05 to 0.2 for each traversal of the barrier.[50] The S-2s would remain close to the convoy, in the hope of reducing the search area.[51] The second barrier would be the surface ship escorts.[52] With-

48. Some Chinese submarines carry fourteen torpedoes, while others carry eighteen or twenty. I therefore use an average of sixteen. Given the proximity, I also assume that the submarines do not keep any torpedoes for self-defense on the return transit.

49. I do not include a defensive minefield as another possible barrier because defensive mines might also destroy merchant shipping.

50. Barrier pk refers to the attrition that a submarine suffers with each traversal. Barry Posen uses a Department of Defense study to compute a barrier pk of 0.18 and suggests a pk of 0.10 as plausible. See Posen, *Inadvertent Escalation,* pp. 174, 260. For assumptions of pks of 0.05 and 0.10, see Wright, "Developing Maritime Force Structure Options for the U.S. Defense Program," p. 158. For an analysis with a base pk of 0.2, but which also doubles and halves the pk, see Nitze and Sullivan, *Securing the Seas,* pp. 350–375. For another analysis suggesting 0.2 as a plausible barrier pk, see Alain C. Enthoven and Wayne K. Smith, *How Much Is Enough? Shaping the Defense Program, 1961–1969* (New York: Harper and Row, 1971), pp. 225–234.

51. S-2s can detect submarines through the use of sonobuoys, radar, magnetic anomaly detection, or line of sight. The use of S-2s also requires air dominance. For analyses suggesting that Taiwan would be able to control the air balance, especially near its coast, see Shlapak, Orletsky, and Wilson, *Dire Strait?;* O'Hanlon, "Why China Cannot Conquer Taiwan"; and John Wilson Lewis and Xue Litai, "China's Search for a Modern Air Force," *International Security,* Vol. 24, No. 1 (Summer 1999), pp. 64–94.

52. The detection assets of the surface ships include hull-mounted sonar and ASW helicopters

out the initial detection from underwater acoustic arrays or intelligence assets, detecting a submarine before an attack would be very difficult. Given Taiwan's small number of ASW assets, shallow water–degrading acoustic detection, and the short range of its nonacoustic detection methods, Taiwan may be forced to rely on sheer luck.[53] Even if the submarine were to snorkel, the dense merchant traffic in the shallow water would make the detection of a periscope very challenging.[54] Given these difficulties, I assume a very low barrier pk of 0.01 for each barrier before the submarine attack. For the submarine attacks, I continue to assume a 0.25 pk for Chinese torpedoes, and every submarine that successfully traverses the two ASW barriers is assumed to find enough targets and be able to engage them within the cycle time.

Once a submarine attacks, the destroyed merchant ship would cue the ASW assets to the submarine's rough location, which would allow the S-2s and ASW helicopters to localize and prosecute. The poor acoustic conditions, however, would complicate the ASW operations, even after the submarine has given up its stealth to attack. Modern submarines carry torpedoes that have longer ranges and travel at faster speeds, which would increase the search area for the ASW assets.[55] Diesel submarines operating in the shallows also have the ability to bottom, making detection very difficult.[56] Moreover, given Taiwan's small

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with dipping sonar. Organizing a convoy operation would be very complicated. Although the Taiwanese navy considers this a likely tactic and trains for it on a limited scale, it needs to pay more attention to implementation on a larger scale. The convoy requirements would be lower than for the Battle of the Atlantic because the convoys would probably only need to escort the merchant ships to and from the shared sea-lanes, as discussed earlier. The number of merchant ships that would require escorting would be much higher, however, than any other historical example. From harbor bureau data, 1,250 ships usually enter and exit the three ports every week. In practice, such an operation would probably look more like a combination of convoys and ships sailing independently.

53. Operating near the convoys should at least ensure that the submarines approach the ASW barriers. For a discussion of the utility of nonacoustic assets for localization, but the difficulty in using these assets for detection, see Tom Stefanick, *Strategic Antisubmarine Warfare and Naval Strategy* (Lexington, Mass.: Lexington Books, 1987), pp. 158, 181.

54. All Chinese submarines have electronic countermeasures, allowing them to detect radars before the radars can detect them. Some of my interlocutors suggest that the PLAN practices snorkeling in the midst of dense merchant traffic, hoping to frustrate detection attempts. For more on the difficulties of periscope detection, see Friedman, "Littoral Anti-Submarine Warfare—Not as Easy as It Sounds."

55. See Lt. Wade H. Schmidt, U.S. Navy, "Top Torpedo," *Proceedings,* Vol. 119 (March 1993), p. 130. Given the number of possible false contacts, however, the submariner might prefer to verify that it is a target and engage at a closer range.

56. A bottomed submarine sits quietly on the ocean floor and is particularly difficult to distinguish from other objects. With an updated library of underwater objects, it is easier to distinguish a bottomed submarine from some other foreign object. There is evidence that the Taiwanese navy periodically maps the bottom topography of its surrounding waters. See "Naval Mine-Hunting Unit Featured," *Lien-Ho Pao,* April 20, 1997, FBIS 97C17034A.

number of escorts and supporting aircraft, it would be a difficult decision to break off from the convoy and pursue a potential contact. Although the submarine attack would help to limit the search area, modern submarine technology, poor acoustic conditions, and a small number of ASW assets suggest that the rate of attrition of submarines even after an attack would be very small.[57] Given these difficulties, I assume a low pk of 0.03 for each barrier on the submarine's return transit. In addition to the parameters and inputs employed in Simulation 1, I double and halve the barrier pks in Simulation 2 to produce a range of potential outcomes. Simulation 2, with varying sensitivities, shows the range of damage that PLAN submarines could inflict on merchant ships when the Taiwanese attempt to use convoy and aircraft ASW barriers. Table 2 shows the number of merchant ships that would be destroyed at the end of a six-month submarine blockade.[58]

lessons of the simulations

Even when many of the assumptions and inputs in the analysis favor China, the low number of PLAN submarines carrying a small number of torpedoes, when compared to the high number of merchant ships, drives the historically low damage that the PLAN would be able to inflict. Although Germany began World War II with only fifty-six submarines, between May 1941 and April 1945, the German navy constructed 1,007 new U-boats, allowing it to maintain a fleet of more than 200 submarines at all times.[59] Over the six-month period of the blockade, given its poor domestic submarine production base and the complexity of post–World War II diesel submarines, China would not be able to increase the number of submarines in its inventory very much, if at all.

As a result of the input values and the design of the convoy battle, a PLAN submarine would produce higher kill ratios per patrol and exchange rates than any other historical engagement.[60] As I have suggested throughout the analy-

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57. With only four diesel submarines to train against, two from the World War II–era, there are also reasons to question the amount of ASW training the Taiwanese navy conducts.
58. To attain a more accurate estimate of the number of ships lost, I assume that half of the ships sunk in the initial simulations were on the way in. For most of the shipping, if a ship is sunk on the way in, it can neither off-load nor pick up new cargo. I double count half of the ships that are sunk to take account of the losses of imports and exports.
59. See Karl Lautenschläger, "The Submarine in Naval Warfare, 1901–2001," *International Security,* Vol. 11, No. 3 (Winter 1986/87), p. 96, n. 2.
60. For the estimate that each German U-boat sunk one ship per attack on an Allied convoy, see Posen, *Inadvertent Escalation,* p. 183. In comparison, the PLAN submarines achieve four kills per cycle. An exchange rate is the number of merchant ship kills per lost submarine. In World War II, U-boats had a mean overall exchange rate of 3.8:1, with a brief spike of 22:1. See Sternhill and

Table 2. Results of Torpedo Scenarios (after six months).

Simulation 1: independent sailing	
Range of merchant ship loss rate:	1.76–6.24 percent 1:57 merchant ships sunk–1:16 ships sunk
Mean loss rate:	3.60 percent 1:28 ships sunk
Simulation 2: ASW barriers	
Range of merchant ship loss rate:	1.51–5.04 percent 1:66 ships sunk–1:18 ships sunk
Mean loss rate:	2.94 percent 1:34 ships sunk

sis, many of the input values are very favorable to the Chinese. Moreover, maintaining the 100 percent finding rate against a convoy does not give the convoy any credit for complicating the submarine's search for targets, for forcing the submarine to attack in suboptimal conditions, or for forcing it to remain submerged, while the rest of the convoy passes by safely.[61] If I were to incorporate these advantages, the result would be fewer opportunities for the submarine to attack than the simulation shows. Overall, the structure of the analysis overestimates the damage that the PRC could inflict, especially against convoys. Despite having history's highest kill and exchange rates, the PLAN's small fleet of submarines would inflict an amount of total damage that seems unlikely to be militarily decisive by historical standards.

Mine Scenarios

Sea mines are cheap and widely available, even in sophisticated forms, and the countermeasures are both expensive and time consuming.[62] This section examines how much damage the PLAN could do to Taiwan by using submarine-laid sea mines. First, it reviews the PLAN's inventory of mines and the

Thorndike, *Antisubmarine Warfare in World War II,* p. 84. Exchange rates for U.S. submarines attacking Japanese shipping were 46:1 in 1942 and 42:1 in 1943. See Hezlet, *The Submarine and Seapower,* pp. 216, 220. For simulation 2, the mean exchange rate is 52.23:1, reaching a high of 116.92:1. These attacks on Taiwanese convoys would be far more deadly than U.S. submarine attacks against mostly unescorted Japanese merchant shipping.

61. See Comdr. E. Cameron Williams, U.S. Naval Reserve, "The Four 'Iron Laws' of Naval Protection of Merchant Shipping," *Naval War College Review,* Vol. 39 (May–June 1986), pp. 39–40.

62. See "Taiwan Intends to Buy U.S. Mine Sweeper for Fear of Mine Blockading Ports," *People's Daily,* April 10, 2002.

potential means for their delivery. It performs an analysis of mine laying, followed by an analysis of mine clearing. Finally, it discusses some of the lessons learned from a submarine mining campaign.

MINE INVENTORY

After World War II, China purchased a large number of mines from the Soviet Union, in addition to producing its own.[63] Bernard Cole estimates that in 2001 China had about 100,000 mines, but a Taiwanese naval officer puts the number closer to 50,000.[64] Although more than 90 percent of China's mines may be old contact mines, the Chinese have domestically produced bottom mines, moored mines, and controlled mines, as well as mines with ship counters and delay mechanisms.[65] Given incomplete information about PRC mine assets, this analysis is based on uncertain assumptions about both the type and quantity of mines in China's inventory.

MEANS OF DELIVERY

The PLA's inability to achieve air dominance over the Taiwan Strait would limit the types of assets that it could use in an offensive mining scenario and would complicate reseeding efforts.[66] Especially if operating close to Taiwanese ports, the PLA would have considerable difficulty using air assets to lay

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63. Mines are usually classified according to their position in the water (drifting, moored, or bottom) and according to their method of actuation (contact or influence). The methods of influence actuation are acoustic, magnetic, or pressure (the most difficult to simulate and counter). "Controlled" mines can be turned on and off. See Thomas R. Bernitt and Sam J. Tangredi, "Mine Warfare and Globalization: Low-Tech Warfare in a High-Tech World," in Tangredi, ed., *Globalization and Maritime Power* (Washington, D.C.: National Defense University Press, 2002), pp. 389–403; Gregory K. Hartmann with Scott C. Truver, *Weapons That Wait: Mine Warfare in the U.S. Navy* (Annapolis: Naval Institute Press, 1991); Tamara Moser Melia, *"Damn the Torpedoes": A Short History of U.S. Naval Mine Countermeasures, 1777–1991* (Washington, D.C.: Naval Historical Center, 1991); and Comdr. James A. Meacham, "Four Mining Campaigns: An Historical Analysis of the Decisions of the Commanders," *Naval War College Review,* Vol. 19 (June 1967), pp. 75–129.

64. See Cole, *The Great Wall at Sea,* p. 103; and "Naval Mine-Hunting Unit Featured," *Lien-Ho Pao,* April 20, 1997, FBIS 97C17034A.

65. See Cole, *The Great Wall at Sea,* p. 103. For a partial list of the mines in the PLAN inventory, see U.S. Department of Defense, *Annual Report on the Military Power of the People's Republic of China,* June 2000. For more details, see A.D. Baker III, ed., *Combat Fleets of the World, 2000–2001* (Annapolis: Naval Institute Press, 2000), p. 105.

66. U.S. bombers in World War II, because they had air superiority, were able to lay mines off the coast of Japan and reseed the minefields quickly and easily from the air. For overall analysis of "Operation Starvation," see W.F. Craven and J.L. Cate, eds., *The Army Air Forces in World War II* (Chicago: University of Chicago Press, 1948); Meacham, "Four Mining Campaigns"; and Hartmann, *Weapons That Wait.*

mines. Surface combatants attempting to lay mines would also be very vulnerable to attack without air dominance. Given these limitations, submarines would be the most effective asset in an offensive mine-laying campaign against Taiwan. With its stealth, a submarine could approach a port covertly, lay mines through its torpedo tubes, and return without detection. Merchant ships, fishing boats, and trawlers could be used in this campaign, but they may have trouble laying advanced mines, and it would be extremely complicated to coordinate a large mining campaign involving merchant ships.[67] The limitation of a submarine-laid offensive minefield would be great given difficulties in reseeding the minefield.[68]

ANALYSIS OF MINE LAYING

One analytical method used to estimate the lethality of a minefield is to look at historical ratios of the number of mines required per merchant ship killed. This measure says nothing, however, about how long it might take for that number of mines to kill the merchant ship, how many ships passed through safely during that period, how many ships were deterred from entering, or the added costs of waiting for the clearing operation. Table 3 shows the mine effectiveness ratios for mining campaigns in World Wars I and II.

These historical data do not reveal which figure would be the most accurate for this scenario. The figures suggest, however, that submarine-laid mines are more accurately placed and therefore more effective. The British after World War II believed that through aggressive mine countermeasure (MCM) operations they could increase this ratio, but Taiwan probably would not have the required number of MCM assets to have this effect.[69] Based on the figures in Table 3 and the aforementioned considerations, I use a baseline ratio of thirty

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67. The ships would need to avoid mines that were already in the water, as well as communicate back to a central post where they positioned mines, which would become more complicated if many ships were involved. Reseeding with a merchant ship is also theoretically possible, but given the earlier caveats, it would be very dangerous.

68. Reseeding would require great confidence in knowing the location of the original mines and in the ability to navigate through a safe zone. A submarine would most likely need to use global positioning satellite technology to establish its position, and then use its inertial navigation unit to navigate through a safe zone to a safe spot to lay mines. The submarine would also need to be confident that the Taiwanese had not laid any defensive minefields in the area.

69. See Meacham, "Four Mining Campaigns." After World War II, the British believed they could significantly increase this ratio through aggressive minesweeping and countermeasures on merchant ships. See Norman Friedman, *The Postwar Naval Revolution* (Annapolis: Naval Institute Press, 1986), pp. 184–185.

Table 3. Historical Mine Effectiveness Ratios, World Wars I and II.

Mining Operation	Number of Mines per Ship Hit	Number of Mines per Ship Sunk
Central powers vs. Allies (World War I total)	67	—
Germans vs. East Coast (1942–44 total)	30	—
British in Europe (World War II total)	47	72
Allies in Pacific (World War II total)	23	37
U.S. air-laid mines in Pacific (World War II)	18	28
U.S. submarine-laid mines in Pacific (World War II)	12	24

mines per ship sunk, a lower figure of fifteen mines per ship sunk, and a higher figure of forty-five mines per ship sunk to produce a plausible range of data.[70]

To determine the potential size and lethality of a Chinese submarine mine blockade, I run three different simulations.[71] I assume that each submarine can carry and lay an average of twenty-six mines per sortie.[72] Because the total number of mines that a submarine can potentially lay depends on whether or not the mines possess delay mechanisms, I run three different simulations, each assuming mines with different levels of sophistication. To produce a plausible range of outcomes, I run each simulation with a 50 percent of submarines operational variant and one with an 80 percent operational variant.

SIMULATION 1: NO DELAY MECHANISM. This simulation assumes that the mines do not have delay mechanisms, making reseeding impossible. It gives the Chinese one opportunity to lay as many mines as it can. Although using submarines from all three fleets may compromise the covert nature of the exercise, with one chance, such a risk would be acceptable.

70. The size of merchant ships has increased substantially since World War II, suggesting that the baseline ratio should perhaps be higher. See also John G. Fox, "Sea Change in Shipping," *Proceedings*, Vol. 127, No. 5 (May 2001), pp. 62–65.
71. George Gilboy, "Naval Mine Warfare against an Island Nation: Japan's Modern Naval Mine Defenses," Department of Political Science, Massachusetts Institute of Technology, 1990.
72. The Kilo can carry twenty-four mines, the Romeo, twenty-eight, and the Ming, twenty-four. Although the exact number of mines the Song can carry is not listed, twenty-four to twenty-eight seems reasonable.

SIMULATION 2: 20-DAY DELAY. More advanced mines have delay mechanisms, which would allow the submarines to lay multiple fields before the mines become activated. The use of delay mechanisms in an offensive mining campaign, however, carries a political risk. If Taiwan discovers the presence of mines before they are activated, it would damage China's international standing and probably lead other countries to support Taiwan.[73] The same risk would apply to the use of offensive remote-controlled mines.

This simulation assumes that the mines laid have a delay mechanism similar to the EM-55 rising mine—up to 480 hours or 20 days. Using submarines from all three fleets could compromise the covert nature of the operation, so this simulation uses submarines only from the East Fleet. In a 20-day period, each submarine would be able to sortie roughly four times.[74]

SIMULATION 3: 250-DAY DELAY. This simulation assumes that the Chinese would use mines similar to the EM-52 rising mines—with a delay mechanism of up to 250 days. I include this scenario because it probably represents the largest number of mines the PRC could lay. To maintain the covert nature of this operation, the PLAN would use submarines only from its East Fleet and would rotate them so as to not alert the Taiwanese. In 250 days, each submarine would make twenty-three sorties.[75] Table 4 shows the number of merchant ships that would be killed by mines after six months.

ANALYSIS OF MINE CLEARING

Another analytical tool involves determining the number of mines the Taiwanese would need to clear to establish a lane of safe passage, called a q-route.[76] Using the U.S. MCM operation at Wonsan in the Korean War as an example, of the 3,000 mines laid, only 225 needed to be cleared for safe passage.[77] This pro-

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73. For the mention of a database of Taiwan's surrounding waters, see "Naval Mine-Hunting Unit Featured."

74. At an average of 10 knots, a round-trip would take 80 hours (3.3 days). Therefore, each sortie, including laying mines would take approximately 4 days. I do not include five sorties because I assume that the submarines would require some routine maintenance.

75. As in simulation 2, a round-trip would take about four days. Given simulation 3's larger window of opportunity, it would seem reasonable to spend some time resting and refitting after each sortie. One week of rest and refit would make an 11-day cycle time.

76. A q-route is "a system of preplanned shipping lanes in mined or potentially mined waters used to minimize the area the mine countermeasures commander has to keep clear of mines to provide safe passage for friendly shipping." See www.fas.org/news/reference/lexicon/deq.htm. Q-routes, which are usually only about 1,000 yards wide, are only the first step in MCM, but usually are enough to allow merchant shipping to pass.

77. For discussions of the MCM operation at Wonsan, see Melia, "*Damn the Torpedoes*," especially

Table 4. Results of Mine-Laying Analysis (after six months).

Number of Submarines Optional	Total Number of Mines Laid	Merchant Ship Kills (lower ratio)	Merchant Ship Kills (baseline)	Merchant Ship Kills (higher ratio)
Simulation 1: no delay mechanism				
50 percent variant	858	57	29	19
80 percent variant	1,326	88	44	29
Simulation 2: 20-day delay				
50 percent variant	1,248	83	42	28
80 percent variant	1,768	118	59	39
Simulation 3: 250-day delay				
50 percent variant	7,176	478	239	159
80 percent variant	10,166	678	339	226

duces a multiplier of 0.075 to attain a rough estimate for the number of mines that would need to be cleared for a q-route to be opened in a blockade against Taiwan.[78]

Although clearing rates are difficult to estimate, the MCM experience at Wonsan is at least instructive. It took a total of 16 days (October 10–25, 1950) for twenty-one MCM ships to clear 225 out of a total 3,000 mines.[79] Thus, each ship was able to clear 0.67 mines per day. For a base case, I assign this same clearing rate of 0.67 mines per each Taiwanese MCM ship.[80] To factor in ad-

chapter 3; Malcolm W. Cagle and Frank A. Manson, *Sea War in Korea* (Annapolis, Naval Institute Press, 1957), especially chapter 4; Roy E. Appleman, *United States Army in the Korean War: South to the Naktong, North to the Yalu (June–November 1950)* (Washington, D.C.: U.S. Government Printing Office, 1961); and Meacham, "Four Mining Campaigns."

78. As in other parts of the article, I have been aggregating, but it is important to remember that the total number of mines would be split between the three routes, requiring a division of assets and three q-routes.

79. For the total of twenty-one minesweepers, see Appleman, *United States Army in the Korean War,* p. 633. The Japanese sent eight civilian sweepers, but they were not involved in the entire operation. The operations began on October 10 with only six minesweepers. See Cagle and Manson, *Sea War in Korea,* p. 134, 136.

80. Applying this rate to a Taiwan scenario may be unfavorable for at least four reasons: (1) Taiwan would have more intelligence and familiarity with the area off its own coast, (2) it would not have to worry about shore fire complicating the clearing effort, (3) it would have more advanced sonars, and (4) Taiwan's MCM assets seem to have a higher readiness than the collection of U.S. reservists and Japanese civilians. For discussions of the difficulties of clearing mines off the enemy's coast, see E. Michael Golda, "The Dardanelles Campaign: A Historical Analogy for Littoral Mine

vances in mine technology and the relatively poor condition of Taiwanese MCM assets, I also use a worst-case scenario, in which the clearing rate is halved to 0.33 mines per day per vessel. Table 5 shows the results of the mine-clearing analysis.

LESSONS OF THE SIMULATIONS

In all three simulations of the mine-laying analysis, the number of kills would be very small, even when a relatively favorable mine effectiveness ratio is used. In two of the three simulations of the mine-clearing analysis, the Taiwanese would be able to clear q-routes within a month, even under pessimistic conditions.[81] Even with the risky strategy of laying mines with 250-day delays, the total number of mines would still be very small by historical standards.[82] With the inability to replenish minefields through aerial drops, and a small number of submarines (even under optimistic conditions), the Chinese would not be able to lay enough mines to be militarily decisive.

Historical Comparisons

Determining the amount of damage necessary to produce capitulation, and therefore successful coercion, is a difficult task. The best available method is historical comparison.[83] Britain's blockade of Germany at the end of World War I did create food shortages, but defeat on the battlefield, and not the blockade, forced Germany's surrender.[84] The German submarine blockades against the Allies in World Wars I and II lasted longer than the PRC blockade would and produced higher merchant shipping loss rates than China could inflict on Taiwan; yet the British were never close to capitulating.[85] Between 1942 and

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Warfare," *Naval War College Review,* Vol. 51, No. 3 (Summer 1998), pp. 82–96; and Meacham, "Four Mining Campaigns."

81. For simulation 3, the situation looks worse for Taiwan. It assumes, however, that the Taiwanese would not map the sea bottom and therefore not detect the presence of minelike objects for 250 days, a heroic assumption.

82. For example, in World War I Britain laid 114,000 mines; in World War II Britain laid 75,000 offensive mines, and the United States laid 25,000 mines against the Japanese. See Hartmann, *Weapons That Wait,* pp. 242–243.

83. For a brief review of the history of naval blockades, see John J. Mearsheimer, *The Tragedy of Great Power Politics* (New York: W.W. Norton, 2001), chapter four.

84. See Nicholas Tracy, *Attack on Maritime Trade* (Toronto: University of Toronto Press, 1991), chap. 2; Gerd Hardach, *The First World War* (Berkeley: University of California Press, 1977); and C. Paul Vincent, *The Politics of Hunger: The Allied Blockade of Germany, 1915–1919* (Athens: Ohio University Press, 1985).

85. See Blair, *Hitler's U-Boat War,* Vol. 1, p. 22. For World War II merchant ship loss rates of 12.5 per-

Table 5. Results of the Mine-Clearing Analysis.

Number of Submarines Optional	Total Number of Mines Laid	Number of Mines Cleared for q-route	Number of Days to Clear q-route (baseline)	Number of Days to Clear q-route (worst case)
Simulation 1: no delay mechanism				
50 percent variant	858	64	8	16
80 percent variant	1,326	99	12	25
Simulation 2: 20-day delay				
50 percent variant	1,248	94	12	24
80 percent variant	1,768	133	17	33
Simulation 3: 250-day delay				
50 percent variant	7,176	538	67	135
80 percent variant	10,166	762	95	191

1945, the United States launched the most effective coercive campaign in history against Japan. The assault included submarine torpedo attacks, submarine mining, aerial mining, and strategic bombing. By the end of the war, it had slashed Japanese imports by 97 percent, including 85–95 percent of key commodities such as oil.[86] Still, the Japanese capitulated only after the United States dropped two atomic bombs on Hiroshima and Nagasaki. Compared with these historical examples, a six-month Chinese blockade of Taiwan, resulting in a relatively minimal amount of damage over a short period, would be unlikely to force a Taiwanese capitulation.

Because Taiwan is so dependent on trade, it is more vulnerable to a blockade than the countries mentioned above, and therefore substantial curtailment of shipping would do more damage to Taiwan's economy. Even under favorable assumptions, however, the amount of damage the PLAN would be able to inflict would be too small to be militarily decisive. Moreover, blockades are

cent, see George R. Lindsey, "Tactical Anti-Submarine Warfare: The Past and the Future," in *Power at Sea,* Adelphi Paper No. 122 (London: International Institute for Strategic Studies, 1976), p. 30. For World War II loss rates ranging from 4 percent to 14 percent, see Roskill, *The War at Sea, 1939–1945,* Vol. 1, p. 458; and Blair, *Hitler's U-Boat War,* Vol. 2, app. 9.

86. See Bernitt and Tangredi, "Mine Warfare and Globalization," p. 392; Michel Thomas Poirier, "Results of the German and American Submarine Campaigns of World War II, October 20, 1999, p. 7; and Mark P. Parillo, *The Japanese Merchant Marine in World War II* (Annapolis: Naval Institute Press, 1993).

slow and need to be sustained for many years to have any chance of being effective. Even though this analysis artificially ends the blockade after six months, with old submarines, poor maintenance, and an inability to procure more quickly, it is probably optimistic to assume that the PLAN could sustain an attempted blockade for this period of time.

Capitulation versus Standing Firm

Coercion is a function of capabilities (the amount of damage inflicted) and political will (how much damage is a populace willing to endure). The brief historical comparisons suggest that even though other campaigns saw more damage inflicted over longer periods of time than the Chinese would be able to inflict on Taiwan, these campaigns were still unsuccessful in forcing capitulation. Taiwan's political will, however, may differ from that of the countries in these examples. If Taiwan's political will were weak, inflicting less damage may still be enough to force capitulation. In an attempt to evaluate Taiwanese will, I divide the analysis into the following sections: shipping concerns; economic concerns; military concerns; threats and elections; and lastly, divisions, sovereignty, and identity. For each section, I present arguments and evidence for Taiwanese capitulation, followed by those suggesting that Taiwan may stand firm and resist.

shipping concerns: the case for capitulation

A Chinese blockade need not destroy a large number of merchant ships to inflict harm on Taiwan's economy and its people. Several analysts argue that even a heightened level of threat would force Lloyd's of London to increase its insurance rates on shipping entering and exiting Taiwan's ports. Even if shipping companies were well compensated for ships lost during the blockade, many might opt to send their vessels into less hostile environments. If merchant ships were deterred from entering this threatening environment, Taiwan's economy would crumble.[87] Lloyd's could also decide not to insure ships entering such hostile waters. Moreover, neutral parties may decide on their own, or under pressure, not to do business with Taiwan. Some might decide that their economic relationships with China are more important than those

87. See Michael O'Hanlon, "Taiwan's Real Bind," *New York Times,* April 20, 2000; Shambaugh, "A Matter of Time," p. 121; and "China's Missile Tests Spark Worries for Taiwan Trade," *Asian Wall Street Journal,* March 6, 1996.

with Taiwan. Taiwan's competitors may try to exaggerate the threat, hoping to maximize their share of the market.[88] In addition, China may decide to cut off its trade with Taiwan.

SHIPPING CONCERNS: THE CASE FOR STANDING FIRM

Even if merchant ships were blown up and insurance companies responded by increasing their rates, history suggests that higher insurance rates would not deter merchant shipping. Historically, shipping companies in wartime made huge profits by entering dangerous areas.[89] Merchant shippers continued to sail throughout World Wars I and II. Despite claims that insurance rates would deter merchant traffic, more than 400 attacks on merchant ships during the tanker wars in the 1980–88 Iran-Iraq War did not substantially affect merchant traffic, and the shipping companies made profits.[90] Recent examples in Lebanon and Croatia have also shown that merchant shipping continues even if insurance rates rise.[91] Although not a true test for Taiwan, the PRC's 1995–96 missile firings did not deter merchant shipping in the strait.[92]

Taiwan also has many options to help maintain merchant shipping levels. Given its large foreign reserves, it could help to subsidize the shipping companies by paying part of the premiums or it could self-insure if Lloyd's stopped insuring merchant vessels entering or exiting Taiwan's ports.[93] The Taiwanese

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88. One of my interlocutors in Taiwan suggested that this happened in 1995–96, although on a relatively small scale.

89. For analysis of profits made by shippers in World War I, see Martin Doughty, *Merchant Shipping and War: A Study in Defence Planning in Twentieth-Century Britain* (London: Royal Historical Society, 1982), especially p. 19. For interviews with merchant shippers about wartime shipping, see "For Shipowners, War Is a Golden Opportunity," *Record* (Associated Press), August 16, 1984.

90. See Richard Harwood, "Saudis Build Seaborne Emergency Oil Stockpile," *Washington Post,* January 1, 1984; "Analyst Says Oil Flow from Gulf Uncurbed," *Boston Globe,* September 10, 1987; and "Shipping Undeterred by Attacks in the Persian Gulf," *Los Angeles Times,* April 23, 1988. For more details, see Nadia El-Sayed, *The Gulf Tanker War: Iran and Iraq's Maritime Swordplay* (New York: St. Martin's, 1999); and Eugene Gholz and Daryl G. Press, "The Effects of Wars on Neutral Countries: Why It Doesn't Pay to Preserve the Peace," *Security Studies,* Vol. 10, No. 4 (Summer 2001), especially pp. 43–46.

91. On Syria's 1989 blockade of the Lebanon coast, see Jim Muir, "Lebanon's Embattled Christians," *Christian Science Monitor,* July 28, 1989, p. 6. On the 1991 Yugoslav blockade of Croatian ports, see Janet Porter, "Croatian Ports Maintain Operations, Insurance Rates Soar," *Journal of Commerce,* October 4, 1991, p. 12B.

92. See Graham Hutchings, "Anger as China Fires Missiles near Taiwan: Poll to Go Ahead Despite Threats," *Daily Telegraph,* March 9, 1996.

93. For a description of Iran's attempt to self-insure, see Youssef Ibrahim, "Nervous Gulf: Iran Boosts Ship-Insurance Program as Saudi Warns of Surge in Oil Prices," *Wall Street Journal,* March 9, 1984.

could charter or buy other vessels on the open market.[94] The United States and other allies, such as Japan, could also assist in paying insurance costs, helping to purchase or charter other merchant ships, reflagging ships, or helping to convince other countries to continue their trade with Taiwan. It is also important to remember that although customers may decide to place future orders with Taiwan's competitors, there would be a time lag before this would have a substantial effect on the economy.

ECONOMIC CONCERNS: THE CASE FOR CAPITULATION

In virtually every instance of cross-strait tension since 1995, Taiwan's stock market has dropped and there has been capital flight. Between China's July 1995 missile tests and its August 1995 military exercises, Taiwan's stock market dropped 20 percent. For all of 1995, the stock market lost 27 percent, and $10 billion flowed out of Taiwan.[95] More recently, Taiwan's stock market fell 5.8 percent after President Chen made his provocative "one country on each side" remark on August 3, 2002.[96] This evidence suggests that a populace that is easily scared by mere threats is one that would not hold up well under a coercive blockade.

ECONOMIC CONCERNS: THE CASE FOR STANDING FIRM

Although Taiwan's stock market has often dropped as a short-term response to uncertainty in cross-strait relations, it has also rapidly adjusted. In March 1996, despite the dips in Taiwan's stock market in anticipation of China's missile tests, by the day of the missile firings, the market had already adjusted and indeed posted gains. In an effort to limit economic damage in times of threat and uncertainty, and to reassure the populace, Taiwan's government has shown a

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94. According to the central bank, Taiwan had $708 billion in foreign reserves at the end of June 2000 and $157 billion in foreign exchange reserves in October 2002. See "CNA: Taiwan's Foreign Exchange Reserves Hit New High," Central News Agency, October 5, 2002, FBIS CPP20021005000051.

95. For discussions of the impact of these crises on the Taiwanese stock market and the resultant capital flight, see Garver, *Face Off*, especially pp. 94, 125. Stock prices fell after President Lee Teng-hui's July 1999 declaration of "special state-to-state relations," the PRC's threatening February 2000 White Paper, and Premier Zhu Rongji's threats before Taiwan's March 2000 presidential election.

96. See "Taiwan: Finance Minister Urges Investors to Not Overreact to Market Plunge," Central News Agency, August 5, 2002, FBIS CPP20020805000. This remark was very controversial because it challenged the idea that both Taiwan and the mainland belong to "one China," and was interpreted by the mainland as a move toward independence.

willingness to use funds to cover stock market losses and capital outflows; in 2000 it even established a National Stabilization Fund to help steady the economy in the event of a crisis.[97] Moreover, only looking at short-term fluctuations in the stock market may overstate the degree of economic panic across Taiwan. In a poll asking people in Taiwan how they felt in response to the PRC's military threats before the 1996 presidential election, 57 percent said not panicky at all and 28 percent said not very panicky.[98] However, some Taiwanese, especially businesspeople, may nevertheless be so anxious that instead of waiting to see what government stabilization might accomplish, they may leave Taiwan, taking their assets with them. Even though this would damage the economy, it could result in a populace that cares more about Taiwan and its continued existence, and would be more likely to stand firm.

MILITARY CONCERNS: THE CASE FOR CAPITULATION

The divided loyalty of the Taiwanese military, between the mainland and Taiwan, may lead one to question how hard the Taiwanese military would fight for the defense of Taiwan. According to a Taiwanese Ministry of National Defense report, 1,266 former Taiwanese military personnel lived on the mainland in 2002, and more than 2,000 retired Taiwanese military personnel regularly visit the mainland.[99] There have also been recent reports of Taiwanese military personnel, active and retired, leaking military secrets to the mainland.[100] The military, especially the officer corps, is composed largely of mainlanders and supporters of the Nationalists or Kuomintang Party (KMT). With the 2000 victory of the more independent-leaning Democratic Progressive Party (DPP) in the presidential election and President Chen's moves toward gradual independence (such as changing Taiwan's passport, calling for a

97. See Peter Montagnon and Laura Tyson, "Chinese Cloud over Taiwan Stocks," *Financial Times,* March 11, 1996, p. 28; and "Taiwan: Stock Market Intervention Incurs 'Huge' Paper Losses for Government," *Taipei Times,* October 17, 2002, FBIS CPP20021017000039.

98. See Chia-lung Lin, "The Political Formation of Taiwanese Nationalism," in Stephane Corcuff, ed., *Memories of the Future: National Identity Issues and the Search for a New Taiwan* (Armonk, N.Y.: M.E. Sharpe, 2002), p. 236.

99. "CNA: Alleged Military Intelligence Leak Caused No Major Harm: Taiwan Navy," Central News Agency, June 12, 2002, FBIS CPP20020612000069.

100. See "Taiwan's Retired Generals, Lawmakers Said Leaking Information to Mainland Authorities," *Tzu-Yu Shih-Pao,* March 16, 2002, FBIS CPP20020318000022; "AFP: Taiwan Journalist Charged with Reporting Military Secrets," AFP, October 14, 2002, FBIS CPP20021014000065; "Taiwan Report on Naval Officer's Father Spying for PRC," *Tzu-Yu Shih-Pao,* June 13, 2002, FBIS CPP20020613000028; and "Taiwan Army Officer in 'Top-Secret' Unit May Have Defected to China," *Taipei Times,* October 16, 2002, FBIS CPP20021016000040.

change in the constitution, and moving toward a referendum), many in the military are unclear what they are supposed to be fighting for.[101] Taiwan's defense budget is also at its lowest since 1996, and the government has been slow in purchasing vital military equipment.[102] A military with such potential loyalty and morale problems suggests that it might not fight particularly hard for Taiwan, which would also undermine the political will of the rest of the populace.

MILITARY CONCERNS: THE CASE FOR STANDING FIRM

The Taiwanese government, recognizing the contradiction between a party army and a democratic government, has been trying since the late 1990s to redefine the Taiwanese army as a national, professional force, accepting of civilian leadership. After new legislation came into effect in March 2002, the Taiwanese military has ceased to be a KMT army and has become a national one in name.[103] President Chen and Defense Minister Tang Yao-ming have begun to visit military bases, hoping to instill greater loyalty, and explain to the military that it should fight for national development and survival.[104] They also point to Taiwan's support for democracy, freedom, and human rights, and how these differentiate Taiwan from the mainland, as something worth fighting for.[105] Although the transition is far from complete, a professional Taiwanese army would likely be more effective and have fewer worries over morale and loyalty.[106]

Tensions between the Taiwanese military and President Chen center on the possibility of future unilateral moves by Chen toward independence, which the military would most probably not support. In the face of a PRC coercive attack, however, the military would likely put these differences aside and fight

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101. See "Taipei Times Examines Low Morale within Armed Forces," *Taipei Times,* July 14, 2001, FBIS CPP20010716000182. Many of my interlocutors in the Taiwanese military expressed annoyance at President Chen's changing rhetoric depending on his audience, which is only increasing the confusion.
102. The defense budget for 2002 was set at NT$259.9 billion. See "Taiwan Defense Budget Hits Eight-Year Low," *Taipei Times,* September 4, 2002, FBIS CPP20020904000138.
103. For more on these two laws, see "Report on Taiwan's Evolving Military," *Taiwan Review,* October 1, 2003, FBIS CPP20030926000173.
104. See "Taiwan Military to Educate Soldiers 'Why We Fight,'" *Taipei Times,* October 1, 2001, FBIS CPP20011001000094; and "CNA: President Chen Urges Military to Defend Taiwan against 'Threat' of China," Central News Agency, September 16, 2003, FBIS CPP20030916000123.
105. See "Taiwan: President Chen Urges Military to Fight for Survival in Armed Forces Day Speech," Office of the President, September 2, 2002, FBIS CPP20020903000250.
106. See M. Taylor Fravel, "Towards Supremacy: Civil-Military Relations in Taiwan's Democratization," *Armed Forces and Society,* Vol. 29, No. 1 (Fall 2002), pp. 57–84.

hard for the defense of Taiwan. Although an imperfect comparison because it was a party army at the time, the Taiwanese army fought several lengthy and deadly battles in the crises of 1954–55 and 1958 to defend Taiwan from Chinese aggression.[107]

threats and elections: the case for capitulation

Taiwan's legislative Yuan election in December 1995 and some aspects of the March 1996 presidential election support the claim that Taiwan is vulnerable to coercion. PRC missile tests in July 1995 and military exercises in August and November of that year, as well as daily criticisms of President Lee Teng-hui, were meant to persuade the Taiwanese populace not to vote for the KMT. In the 1995 elections, the KMT lost seven seats to maintain a slim majority and did not receive a majority of the popular vote. The New Party, which broke away from the KMT and was more accommodating to the mainland, tripled its number of seats. In the 1996 presidential election, which was also preceded by exercises and missile tests, the pro-independence DPP candidate, Peng Ming-min, received fewer votes than most experts expected.[108]

threats and elections: the case for standing firm

The Taiwanese populace's response to mainland threats before the 1996 and 2000 presidential elections suggests that Chinese threats are likely to backfire, resulting in more support for the candidates that stand up to the mainland. In the 1996 presidential election, Lee Teng-hui called on the populace to stand firm and unite behind democracy and the KMT.[109] The results were an overwhelming victory for Lee, who won 54 percent of the vote. Most experts estimated that the mainland's threats gave Lee between five and ten more percentage points in the popular vote.[110] On the eve of the March 2000 presidential election, the PRC released a White Paper in February threatening the use of force if Taiwan continued to refuse to negotiate; and China's president,

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107. See Xiaobing Li, "PLA Attacks and Amphibious Operations during the Taiwan Strait Crises of 1954–55 and 1958," in Mark A. Ryan, David M. Finkelstein, and Michael A. McDevitt, *Chinese Warfighting: The PLA Experience since 1949* (Armonk, N.Y.: M.E. Sharpe, 2003), pp. 143–172.
108. See Garver, *Face Off;* and John F. Copper, "Taiwan's 1995 Legislative Yuan Election," Occasional Papers/Reprints Series in Contemporary Asian Studies, No. 1 (College Park: University of Maryland School of Law, 1996).
109. See "Li Says Democracy Stronger than PRC 'Threats,'" Hong Kong AFP, March 22, 1996, FBIS FTS19960322000077.
110. Lee Teng-hui won 54 percent of the popular vote. For the estimates of backlash, see John F. Copper, *As Taiwan Approaches the New Millennium: Essays on Politics and Foreign Affairs* (Lanham, Md.: University Press of America, 1999), pp. 90–91.

Zhu Rongji, warned in March that voting for Chen risked war.[111] The result of the election was a Chen victory with 39 percent of the popular vote.[112]

DIVISIONS, SOVEREIGNTY, AND IDENTITY: THE CASE FOR CAPITULATION

Among Taiwanese, there are ethnic divisions, divisions over self-identification (Taiwanese, Chinese, or both), and divisions over the desired political future of Taiwan.[113] The divisions among Taiwan's political parties are obvious whenever the government takes steps toward independence. After President Chen's "one country on each side" speech, and in late 2003 when Chen pushed for a referendum, his political rivals, as well as business leaders, criticized him for needlessly risking war.[114] These internal divisions do not suggest that the Taiwanese would unite and stand firm against the mainland, especially as many Taiwanese still see their cultural identity as coming from Han China.

Although historical examples suggest that populaces can stand united in the face of attack, these examples are neither appropriate nor applicable. Great Britain, Germany, and Japan resisted and stood firm, but these were well-established, internationally recognized countries defending their sovereignty and fighting for their national survival in a lengthy world war. Taiwan is not a country. One can argue that none of these terms—country, sovereignty, or national survival—are really appropriate to Taiwan. Overall, these many weaknesses and divisions in Taiwanese society suggest that it is very likely to collapse and capitulate if the PRC attacks.[115]

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111. See "Ta Kung Pao Cites Zhu Rongji on Taiwan Issue," *Ta Kung Pao,* March 16, 2000, FBIS CPP20000316000009.

112. Most reports suggest that the threats increased the vote for Chen by 2–3 percent. See "Gap between PRC, Taiwan Said 'Widened' after Elections," *South China Morning Post,* March 22, 2000.

113. For a discussion of the ethnic divide between Hakka, Fulao, mainlanders, and aborigines, see Liu I-Chou and Ho Szu-yin, "The Taiwanese/Chinese Identity of the Taiwan People," *Issues and Studies* (May/June 1999), pp. 1–34. Virtually every chapter in Corcuff's book discusses difficulties and divisions over self-identification. See Corcuff, *Memories of the Future.* According to Taiwan's Mainland Affairs Council (MAC), 42.5 percent identified themselves as Taiwanese, 38.5 percent as both, and 13.6 percent as Chinese. See MAC, "Public Opinion on Cross-Strait Relations in the Republic of China," June 2000, http://www.mac.gov.tw. According to MAC data, 35.8 percent of people support status quo now/decision later, 13.7 percent status quo now/unification later, 15.9 percent status quo now/independence later, 16.8 percent independence indefinitely, 5.7 percent independence as soon as possible, and 0.9 percent unification ASAP. See MAC, "Public Opinion on Cross-Strait Relations in the Republic of China," May 2003, http://www.mac.gov.tw.

114. See "Taiwan Business Leaders 'Express Dismay' over President's Remarks," *China Post,* August 6, 2002, CPP20020806000188; "Taipei Times: Opposition Criticizes Chen's Call for Referendum," *Taipei Times,* August 4, 2002, FBIS CPP20020804000019; and "Taiwan: KMT Chair Urges President to Abandon Push toward Independence," *Taiwan News,* December 8, 2003, FBIS CPP20031208000190.

115. For interviews with Taiwanese suggesting that the lack of unity about the future would pre-

DIVISIONS, SOVEREIGNTY, AND IDENTITY: THE CASE FOR STANDING FIRM

Although there are many divisions in Taiwan, the Taiwanese are proud of their economic and political accomplishments. These accomplishments, coupled with a different historical experience from the mainland since 1895, have helped to forge a Taiwanese consciousness and Taiwanese identity.[116] This growing sense of Taiwanese identity is an empirical fact whose origins scholars have recently begun to explain.[117] Schools using textbooks focused on Taiwanese history, people speaking Taiwanese (as opposed to Mandarin Chinese) in all types of situations, and government decisions to change national emblems such as the flag and passport have further ingrained this sense of Taiwanese identity.[118] There is an unmistakable growing identification with Taiwan, accompanied by a decreasing identification with mainland China.

With the exception of international recognition, Taiwan has all of the attributes of a country. Moreover, politicians from all political parties in Taiwan refer to the Republic of China as a sovereign and independent entity that should be respected as such by the mainland.[119] Although political opponents criticized Chen for risking war with his "one country on each side" speech, most did not

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vent Taiwan from being unified if China attacked, see William Foreman, "Does Taiwan Have the Stomach for War?" *Athens Daily News* (Associated Press), April 26, 2001.

116. In the 1895 Treaty of Shimonoseki, China lost control of Taiwan to Japan; Taiwan would remain a Japanese colony until the end of World War II. After fleeing to Taiwan in 1949, the KMT would rule the island nation, while the PRC would rule the mainland. The experiences of Taiwanese and mainlanders have been very different for more than a century, and the PRC has never exercised sovereignty over Taiwan.

117. According to an October 2003 *United Daily News* poll, 62 percent of respondents identified themselves as Taiwanese, whereas only 16 percent identified themselves as Taiwanese in 1989. Only 19 percent identified themselves as Chinese, down from 52 percent in 1989. See Philip P. Pan, "New National Identity Emerges in Taiwan: Culture Shifting Away from the Mainland," *Washington Post,* January 2, 2004. According to MAC data, between January 1993 and July 2001, those identifying themselves as Chinese fell from 48.5 percent to 13.6 percent, those identifying themselves as both rose from 32.7 percent to 38.5 percent; and strikingly, those identifying themselves as Taiwanese rose from 16.7 percent to 42.5 percent. See Corcuff, *Memories of the Future;* A-chin Hsiau, "*Contemporary Taiwanese Cultural Nationalism* (London: Routledge, 2000); Angelina Chun-chu Yee, "Constructing a Native Consciousness: Taiwan Literature in the 20th Century," *China Quarterly,* Vol. 165 (March 2001), pp. 83–101; Yun-han Chu and Jih-wen Lin, "Political Development in 20th-Century Taiwan: State-Building, Regime Transformation, and the Construction of National Identity," ibid., pp. 102–129; and Lee Teng-hui, "Understanding Taiwan: Bridging the Perception Gap," *Foreign Affairs,* Vol. 78, No. 6 (November/December 1999), pp. 9–14.

118. For good reviews of these developments, see Pan, "New National Identity Emerges in Taiwan"; and David Lague, "Goodbye to the Mainland," *Far Eastern Economic Review,* February 7, 2002.

119. For recent discussions of the political developments on Taiwan in the 1990s, see Bernice Lee, *The Security Implications of the New Taiwan,* Adelphi Papers No. 331 (Oxford: Oxford University Press, 1999); and Sheng Lijun, *China's Dilemma: The Taiwan Issue* (New York: I.B. Tauris, 2001).

challenge his assessment of the status quo. Moreover, polls suggest that a majority of the populace agreed with his formulation.[120] Even if Taiwan is not an internationally recognized country, its leaders still use terms such as country, sovereignty, and national survival.[121]

The Taiwanese are also united in their belief that Taiwan should determine its own future. In a 1998 poll by Taiwanese political scientist Liu I-chou, 74.5 percent of respondents answered that only residents of Taiwan have a right to determine Taiwan's future.[122] As President Chen pushed for a referendum in late 2003, with popular support for self-determination, it was difficult for rival party leaders to oppose the concept of a referendum, even if these leaders feared such a move might push Taiwan closer to independence, increasing the chance of war.[123] The support for democracy and popular choice seems to be strong, irrespective of ethnic divisions, political party, or policy preferences.[124]

The PRC's continued pressure and aggressive behavior have been important factors in shaping a Taiwanese consciousness and sense of identity. If a PRC use of force was provoked by a Taiwanese declaration of independence, these fissures would very likely produce a divided populace and a quick capitulation. However, if the PRC used force hoping to exploit these fissures, Taiwan's populace and political parties would likely find ways to unify and oppose this aggression. According to a poll by the Chinese Eurasian Foundation, 75 percent of Taiwanese adults said they would be willing to go into battle to defend the island.[125] When asked, "If Beijing pressures Taiwan, will [the] people of

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120. See "Taiwan: Former President Says Don't 'Panic' Over Chen's Remarks," *China Post,* August 6, 2002, FBIS CPP20020806000190; and "Taiwan President Says Remarks 'Oversimplified,'" *Taiwan News,* August 7, 2002, FBIS CPP20020807000173.

121. See "SCMP: Chen Shui-bian Asserts Taiwan 'Undeniably' Sovereign Nation," *South China Morning Post,* December 8, 2003, FBIS CPP20031208000139; "CNA: President Reaffirms 'No Compromise' on Taiwan Sovereignty," Central News Agency, June 28, 2001, FBIS CPP20010628000120; and "Taiwan: Lien Chan Urges Return to 'One China, Separate Interpretations' Basis," Central News Agency, October 18, 2000, CPP20001018000067.

122. See Shelley Rigger, "Social Science and National Identity: A Critique," *Pacific Affairs,* Vol. 72, No. 4 (Winter 1999–2000), p. 549.

123. See "Taiwan Referendum Law Passed, Largely Pan-Blue Creation," *Tzu-Yu Shih-Pao,* November 28, 2003, FBIS CPP20031128000106.

124. See Rigger, "Social Science and National Identity"; and Tsong-jyi Lin, "The Evolution of National Identity Issues in Democratizing Taiwan: An Investigation of the Elite-Mass Linkage," in Corcuff, *Memories of the Future,* pp. 123–143.

125. "CNA: Majority of Taiwan Residents Willing to Bear Arms: Poll," Central News Agency, July 14, 2002, FBIS CPP20020714000016. Although the results of this poll show a 13 percent drop over four years, this still a very high percentage. There is not enough information available from the poll to explain this change.

Taiwan support the government to stand up to Beijing?" KMT leader and former Vice President Lien Chan replied, "What other alternative is there?"[126] A use of force under those conditions would represent a challenge to Taiwan's sovereignty, right of self-determination, and dignity—all issues on which there is agreement. In every historical attempt at coercion, the populace has responded with unified anger directed against the attacker and has shown the ability to endure much pain in defense of their home country. Foreign aggression has also often served as a unifying force, drawing people of different backgrounds and political viewpoints to stand up to a foreign attack.[127] Taiwan would very likely respond to a coercive attack as every other state in history has: by standing firm.

Lastly, there is also widespread agreement that the "one country, two systems" formula is not applicable because, under such an arrangement, Taiwan would be considered a subordinate government.[128] According to data from Taiwan's Mainland Affairs Council, only 10.3 percent of people believe that this formula is applicable to solving the cross-strait problem, with 73 percent of people believing it is not.[129] The Taiwanese are unsure how this formula would work in practice. Moreover, as popular protests erupted in Hong Kong against the government's attempt to pass an oppressive and restrictive antisubversion law, the Taiwanese have become even more convinced that this formula is not right for them.[130]

Conclusion

To better understand the threat that China might pose to Taiwan, and therefore U.S. interests in East Asia, this article has performed a military and political analysis of a coercive submarine blockade of Taiwan. The analysis suggests

126. See "VP Lien Chan Interviewed by *Time* Magazine," *Chung-Yang Jih-Pao,* July 26, 1999.
127. See Pape, *Bombing to Win,* pp. 21–27. He cites such coercive failures as Germany versus Britain (World War I and World War II), France in the Rhineland (1923–24), Italy versus Ethiopia (1936), United States versus Japan (1941), Allied bombing of Germany (World War II), U.S. bombing of North Vietnam (1965–68), and Soviet operations in Afghanistan (1979–88). See ibid., p. 2. For other discussions of why coercion fails, see Mearsheimer, *The Tragedy of Great Power Politics,* chap. 4.
128. See "TN Editorial Sees 'One Country, Two Systems' as Failed Policy," *Taiwan News,* July 1, 2002, FBIS CPP20020701000167; and "CNA: Taiwan President Decries Beijing's 'One Country, Two Systems' Model," Central News Agency, July 13, 2001, FBIS CPP20010713000149.
129. See MAC, "Public Opinion on Cross-Strait Relations in the Republic of China," May 2003, http://www.mac.gov.tw.
130. See Robert Marquand, "Hong Kong's Rallies Test China's 'Two Systems' Policy," *Christian Science Monitor,* July 10, 2003.

that with a relatively large fleet of submarines, combined with Taiwan's geographical proximity, the PLAN would be able to impose costs on Taiwan. If, however, the goals accompanying the use of force were reunification under the "one country, two systems" formula, the campaign would be able to force capitulation only if the Taiwanese had virtually no political will and surrendered quickly. Although there is evidence to suggest that Taiwan might capitulate, there is more evidence to suggest that Taiwan would stand firm. Although the conventional wisdom is that a Chinese submarine blockade is a real threat to Taiwan, this analysis suggests that this claim is overstated.

One of the lessons of this analysis is that the Chinese should not be too confident in the success of a coercive submarine blockade. A PRC decision to use force would be a bet that the arguments for collapse are much stronger than those for standing firm. Although a quick collapse and coercive success would be possible, using force would damage China's economic development and risk the possibility of escalating to nuclear war.[131]

Although the amount of damage the Chinese could impose on Taiwan with a submarine blockade would be limited, Taiwan still needs to improve its ASW and MCM capabilities. With such a small number of ASW assets, Taiwan should focus on integrating them and developing a more thorough command and control structure, to produce a quick, coordinated response once a submarine is detected. With so few MCM assets, maintenance problems or substantial attrition would greatly reduce effective MCM operations. Taiwan also needs to continue to map the ocean bottom topography to help detect inert minefields, clear active ones, and facilitate the detection of submarines. Moreover, it needs to communicate these activities to the mainland, explaining the risks that the Chinese might be taking if they attempt to lay inert mines. Given that the Chinese have taken notice of the lack of Taiwanese ASW and MCM capabilities, improving these capabilities should help to deter a PRC attack; and if deterrence broke down, these assets would help to reduce the damage the Chinese would be able to inflict and reassure the Taiwanese populace.

Even if little can be done to limit Taiwan's reliance on trade, leaders can still take measures to reduce Taiwan's vulnerability to a submarine blockade. Taiwan should develop its eastern ports. This would require a blockading submarine force to travel longer distances and seal more ports to be successful.

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131. The costs to the PRC of a failed use of force could be the subject of another article. At the very least, these costs would include threatening the survival of the regime, setting back the economic modernization project, risking the destruction of China's military and damage to the homeland if war broke out with the United States, losing diplomatic face in the international community, and forcing Taiwan to declare independence.

Taiwan should also maintain larger oil reserves. The Taiwanese government also needs to develop response plans in the event of a use of force. For example, after hostilities began, if the Taiwanese government did not seem to be making an effort to organize convoys, take actions to ensure ships will continue to sail (chartering, buying ships, bribery, or coercion), or have a plan of how to sustain the economy while minefields were being cleared, the government would appear to have lost control, which could undermine the will of the populace. The government should also continue its campaign to highlight Taiwan's embrace of freedom and democracy, reminding the Taiwanese populace what they would give up if they capitulated.

The United States should continue its arms sales to Taiwan, especially defensive weapons such as ASW and MCM assets, and pressure Taiwan to follow through on such purchases. Many countries, including the PRC, focus on the military balance across the Taiwan Strait. If the PRC continues its military buildup, and the Taiwanese do not build up in response, Chinese leaders' beliefs that the military balance favors China might undermine deterrence. In addition to potentially enhancing deterrence, arms sales may help to convince the people of Taiwan that their government and military are willing and able to fight back, increasing the chances that the populace would stand firm. Buying these assets and showing the willingness to fight back might also help to convince third parties to be more willing to assist Taiwan in the event of an attack.

In considering U.S. military intervention in the event of a PRC submarine blockade, most discussions focus on how much force would be required to break the blockade. In judging the success of a PLAN blockade, however, this is the wrong question. The analysis should start with whether or not a Chinese blockade could accomplish its objectives and force Taiwan to capitulate. In a blockade, the burden of proof is on the PLAN. Many analysts correctly note the difficulty of ASW and MCM operations. However, launching a blockade with enough submarines to substantially damage another country's economy is also a very difficult task.

A modern PLAN submarine force will most likely include a significant reduction in the total number of submarines, with an emphasis on advanced diesel submarines and nuclear attack submarines.[132] A modern submarine force,

132. See Cole, *The Great Wall at Sea*. Although the PLAN is developing advanced antishipping cruise missiles (ASCMs), using these to attack merchant ships would be very expensive. ASCMs are more likely to be used against surface combatants or aircraft carriers.

however, would probably be unable to inflict more damage on Taiwanese shipping than the current submarine force was able to inflict in the simulations. These simulations have already assumed a 100 percent finding rate, quick cycle times, good maintenance, high pks, and high survivability by making the Taiwanese ASW barriers so low. In the torpedo scenarios, in which attrition of total merchant shipping is the most important consideration, a smaller force, even if it is more capable, would not be able to inflict as much damage as that inflicted on Taiwan in the simulations. For mining scenarios, fewer submarines would mean fewer mines that could be laid in a blockade scenario. Although advanced submarines may have more potential for reseeding minefields, this would still be risky. This does not mean that the Chinese would not be able to impose substantial costs on Taiwan with a smaller, more advanced force, but such a small force would be unlikely to destroy as much shipping as these simulations. This also does not mean that a smaller, modern submarine fleet would not pose other threats. The existence of quiet submarines represents a "force in being" and may limit naval operations and force the U.S. Navy to hesitate before entering areas suspected of having submarines. It would also require a disproportionate number of assets if the U.S. Navy wanted to destroy these advanced submarines. The submarine force may present different potential threats in the future, such as to carriers and surface combatants, but a small, advanced submarine force would most likely not be able to inflict enough damage on merchant shipping to be decisive.

Although Taiwan is less vulnerable to a submarine blockade than conventional wisdom suggests, the implications of this analysis are not that Taiwan is "safe." In fact, the opposite is true. Given a relatively large submarine fleet, geographical proximity, and a favorable acoustic environment, PLAN submarines can impose costs on Taiwan. Even if the U.S. military were to intervene to defend Taiwan, this would not prevent the PRC from imposing costs on Taiwan. However, given the limited amount of damage the PLAN could impose on Taiwan, even without U.S. military intervention, U.S. political and economic support of Taiwan may be more important in making sure it stands firm. However, believing that Taiwan is safe can be very destabilizing for cross-strait relations. If the Taiwanese government believes that it is safe, it may be more likely to move in the direction of independence. These moves, especially a declaration of independence or call for a referendum, could produce a situation where the Chinese would feel that they had no other choice but to use force. In the short-to-medium term, the only way a Chinese use of force will succeed is if Taiwanese political will collapses. If the idea that Taiwan is

safe spreads throughout the populace, it will make them psychologically unprepared for war, should it happen. Such a situation will make the collapse of Taiwanese political will and morale more likely. Spreading the false belief that Taiwan is safe only makes war more likely, and makes it more likely that Taiwan will capitulate if there is a war.