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China's Undersea Sentries
Traditionally a continental power, Beijing has not wielded strong naval forces in the modern era. But this is beginning to change now and China is making rapid strides, particularly in the arena of undersea warfare. According to the New York Times, China launched 13 submarines during the period 2002-04\(^\dagger\) — and this number does not include the recent sale of eight Kilo-class diesels from Russia that was accomplished by 2006. Indeed, China commissioned thirty-one new submarines between 1995 and 2005\(^\dagger\). Less well understood by naval analysts and planners is the People’s Liberation Army (PLA) Navy’s dynamic mine warfare component. It is important to understand this emerging capability, because sea mines appear to be a big component of Beijing’s Anti-Submarine Warfare (ASW) strategy.
This article is part of a larger study that surveyed nearly one thousand Chinese language articles related to mine warfare. The major conclusions of that study are that China's naval mine inventory likely contains some of the world's most lethal systems and that Beijing may be on the cutting edge of mine warfare (MIW) technology and concept development. The study elucidates a preliminary outline of a Chinese MIW doctrine that emphasizes speed, psychology, obfuscation, a mix of old and new technologies, and a variety of deployment methods that target very specific U.S. Navy platforms and doctrines. Two research questions from that larger study are explored in this article: first, Chinese strategists note that “submarines are acutely vulnerable to mines, because passive sonar is not likely to be effective in locating mines, and because submarines have very limited organic mine countermeasures (MCM) capabilities.”

Lacking a substantial modern naval history, Chinese naval analysts are scrupulously analyzing foreign naval history for lessons to facilitate their development, and have duly noted the potential for mine warfare to “baffle the enemy, and thus achieve exceptional combat results.”

As a Chinese textbook relates, 2,500 ships were sunk by sea mines during WWII. Another Chinese analysis notes that in the same conflict Germany lost 27 U-boats to mines. Perhaps not surprisingly, Chinese naval strategists have a keen understanding of Soviet naval doctrine, appreciating in particular how mine warfare was revived during the late Cold War in part for the purpose of countering American nuclear powered fast-attack submarines (SSNs). Indeed, one Chinese survey of ASW explains how new mines emerged in the 1980s “that are more appropriate to the requirements of modern anti-submarine warfare.” A detailed Chinese analysis of Russian rocket mines concludes: “...these weapons will attack SSNs too rapidly for countermeasures to engage, and are also rated to be highly effective against the mono-hull construction of U.S. submarines.” Chinese strategists have also very closely analyzed the mine warfare aspects of the Persian Gulf War during 1990-91, noting that although two U.S. Navy (USN) ships were severely damaged, Iraq's MIW campaign had numerous flaws, including an “inappropriate reliance on moored mines [and a failure to execute] long range offensive mine warfare operations.” It is now conventional wisdom in the PLA Navy that “relative to other combat mission areas, [the U.S. Navy’s] mine warfare capabilities are extremely weak.”

PLA Navy strategists envision a wide array of platforms (including non-military vessels) for delivery of sea mines for operational deployment. Having systematically analyzed the advantages and disadvantages of these mine-laying platforms, they appear to have concluded that submarine delivery of mines is optimal for offensive, and especially long-range offensive, mine-laying missions. According to one analysis, “the restrictions imposed on submarines by air and naval forces are relatively small, [so] penetrating the enemy’s rear area to lay mines is much easier.” Also, according to another report, this platform “has the highest qualities of stealth and potential for surprise ... [because] a vessel set at a distance of 10-15 km outside of a harbor, in a sea area with a depth of about 40 m, will be capable of launching an effective mobile mine to penetrate a port...”

**China’s Naval Mine History**

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

China’s remotely controlled mines, such as the EM53 bottom influence mine, are thought to be deactivated by coded acoustic signals to allow the safe passage of friendly vessels, and again activated to prevent the transit of those of an enemy. Remotely controlled mines are well suited to defensive mining purposes, but could be useful in offensive operations as well.

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

Significantly, China began to develop rocket rising mines in 1981 and produced its first prototype in 1989. Thus, Beijing has been working on this technology for well over two decades. Today, China reportedly offers two types of rising mines for export. Rising mine systems are moored, but have as their floating payload a torpedo or explosive-tipped rocket that is released when the mine system detects a suitable passing vessel. The torpedo or rocket rises from deep depth to home in on and destroy its intended target, typically a submarine. As one source notes, “The so-called ‘directional rocket rising sea mine’ is a type of high technology sea mine with accurate control and guidance and initiative attack capacity. Attack speed [e.g., against a target submarine] can reach approximately 80 meters per second.” China’s EM52, a guided rocket propelled destructive charge, reportedly has an operating depth of at least 200 meters. Russian rising torpedo mines such as the PMK-2 are said to be capable of being laid in waters as deep as 2,000 meters.

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

Research Vectors

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

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

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

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

Training

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

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

The Chinese Navy is working hard to improve the quality of its submarine officers and sailors, including their proficiency in MIW. China’s official radio cited PLA Navy submarine detachment topedo and mine officer Chao Chunyi for achieving sixteen research results in underwater mine-laying training, cutting mine loading time in half, and developing a mine movement control device. Song Submarine 314 Commander Ma Lixin, a celebrity in China’s naval press, recently led an East Sea Fleet submarine detachment to “develop tactical innovations.” In the past year, Ma researched and developed over ten new operational methods “including how to carry out a blockade and how to lay mines using conventional submarines.” In early 2005, Ma “led his unit to participate in live exercises at sea… they arrived at a designated area to…” lay mines.” In an early 2005 mine exercise, Ma was charged with evading ‘enemy’ ASW airplanes, a mine field, and – most difficult of all – an adversary submarine, in order to lay mines in a nearby area. He used his mastery of the local environment, adopted minimum noise navigation speed, eluded the ‘enemy’ submarine and shore radar and accomplished the mine laying mission on time. In summarizing such achievements, a source notes, “This year there occurred even more enhanced submarine mine exercises with step-by-step progress.”

Scenarios

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

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

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

**Implications**

Given increasing economic interdependence, not to mention similar interests on such key issues as terrorism and affordable energy, military conflict between Beijing and Washington is a low probability outcome that would likely be injurious to both states' interests. The nature of the Pacific Theater, coupled with expanding Chinese capabilities to threaten surface and air assets, puts additional impetus on the U.S. to hedge for all contingencies.

U.S. submarines are highly survivable, but in this case a "mission-kill" damaged submarine may be almost as good to adversary war planners as a destroyed submarine. Moreover, as a recent article in the Spring 2006 issue of UNDERSEA WARFARE Magazine notes, "submarine[s]... cannot use all the mine-clearing tools available to surface ships... pre-cursor sweeping before transiting a minefield is generally not an option..." ["Underwater Stealth: Mine Countermeasures' Ace in the Hole", UNDERSEA WARFARE, Spring 2006, pg. 12]

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


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