

Chinese Threats to U.S. Surface Ships

An Assessment of Relative Capabilities, 1996–2017

Over the past two decades, China's People's Liberation Army (PLA) has transformed itself from a large but antiquated force into a capable, modern military. A RAND Project AIR FORCE report assesses trends in the relative capabilities of U.S. and Chinese forces in diverse operational areas, and at varying distances from the Chinese mainland, between 1996 and 2017. The overall conclusion is that although China continues to lag behind the United States in terms of aggregate military hardware and operational skills, it has improved its capabilities relative to those of the United States in many critical areas. Moreover, the report finds that China does not need to catch up fully to the United States to challenge the U.S. ability to conduct effective military operations near the Chinese mainland. To be clear, the goal is to avoid war, which the authors do not anticipate and which would be disastrous for both countries. Rather, this research provides an open-source assessment of trends that could affect U.S. defense and deterrence efforts and establishes a baseline for future analysis.

Focus on Chinese Anti-Surface Warfare

This brief focuses on one area in which China has made rapid and substantial relative improvements: its ability to locate and attack U.S. surface ships, especially aircraft carriers, in conflicts centered on Taiwan or the Spratly Islands.

During the Taiwan Strait Crisis in 1996, China was reportedly unable to locate, much less attack, two U.S. aircraft-carrier battle groups in the waters around Taiwan. In contrast, China can now hold the U.S. Navy's surface fleet at risk at significant ranges from the mainland. This threat to the U.S. surface fleet continues to grow. China's anti-surface capability is founded on four developments: (1) the establishment of an increasingly capable long-range maritime surveillance capability designed to detect and track surface ships, (2) the deployment of sophisticated anti-ship cruise missiles and the world's first anti-ship ballistic missile, (3) the acquisition of strike aircraft with greater range and power, and (4) the deployment of new classes of larger and quieter submarines armed with cruise missiles and torpedoes.

While the development of China's anti-ship ballistic missile capability has garnered headlines, this analysis suggests that the PLA's steady (but less heralded) development of

Key findings:

China has rapidly improved its ability to reliably locate and to attack U.S. carrier-strike groups at distances of up to 2,000 km from its coast. Depending on the degree of risk U.S. commanders are willing to tolerate, the danger to U.S. carriers could be mitigated by holding them farther from the Chinese coast. However, this would result in fewer total sorties by naval aircraft, which would have to fly longer distances, and it would place greater demands on the U.S. Air Force for tankers to fuel them. The United States will look to counter this growing threat by developing ways to degrade Chinese intelligence, surveillance, and reconnaissance capabilities and by improving its own anti-missile, anti-submarine, and defensive counterair capabilities. But it will also want to consider alternative concepts of operation that rely less on the early use of carriers in waters near China's coast.

quieter, more capable submarines represents a more immediate threat—one that puts U.S. carrier-strike groups within 2,000 km of the Chinese coast at significant risk. In 1996, China had taken delivery of only two submarines that could be described, by any reasonable definition, as modern. The remainder of its fleet consisted of legacy boats based on 1950s technology, lacking teardrop shaped hulls and armed only with torpedoes. By 2017, China will have a smaller but more capable fleet, with 49 modern ships, including both Russian *Kilo*-class boats and indigenous designs. China's recent submarine classes are armed with both sophisticated cruise missiles and torpedoes, greatly increasing the range from which they can attack. Although most Chinese boats are diesel-powered and none is not up to U.S. standards, they could nevertheless threaten U.S. surface ships.

Assessing the Submarine Threat in the Taiwan and Spratly Islands Scenarios

The researchers assessed various aspects of Chinese intelligence, surveillance, and reconnaissance (ISR) capabilities and the anti-surface warfare battle. This discussion is lim-

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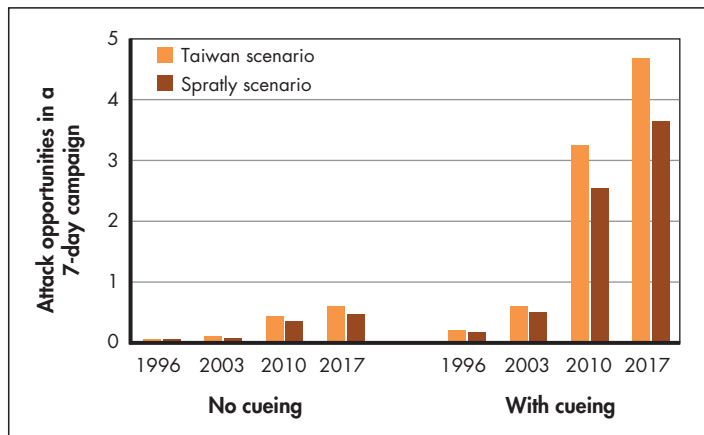
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ited to the modeling of Chinese submarine attacks against U.S. carriers in two scenarios at varying distances from the mainland: a Chinese invasion of Taiwan and a campaign to occupy a portion of the Spratly Islands. Inputs included sensor ranges, weapon capabilities, the movement speed of Chinese submarines and U.S. warships, and the ability of U.S. anti-submarine warfare assets (including submarines, maritime patrol aircraft, and helicopters) to screen the fleet and to detect and suppress or destroy Chinese submarines.

The primary output metric was “attack opportunities”—the number of times Chinese submarines could reach positions to attack a U.S. aircraft carrier over a seven-day period. In assessing each scenario, the team considered cases in which each submarine acted individually with no external sources of information about the location of U.S. carriers and cases in which the submarines received cueing about the target location once every 24 hours. The results are not intended to represent fully developed or precise predictions. But given the consistency of the methodology applied over the period considered, they provide a good indicator of trends over time, as well as an idea of the general scale of the challenge at any given point in time.

As shown in the figure below, under all scenarios and circumstances considered, Chinese capabilities to generate submarine-attack opportunities increased by more than an order of magnitude between 1996 and 2010—and further increases are likely through 2017. This improvement came

Total Expected Chinese Submarine Engagement Opportunities Against a Single U.S. Aircraft Carrier in a Seven-Day Campaign



despite a reduction in the overall size of China’s submarine force and improvements to U.S. anti-submarine warfare capabilities. The quieting of Chinese submarines and the addition of cruise missiles largely accounts for the change.

A second notable pattern is that even occasional cueing from other ISR assets regarding the location of U.S. carrier-strike groups would increase the ability of Chinese submarines to engage U.S. aircraft carriers by nearly an order of magnitude above that without cueing. While it is not possible to confidently assess how often cueing might be provided in an actual conflict, improvements to Chinese ISR have improved the chances that Chinese submarines will receive such information. Chinese submarine commanders may not execute an attack every time they have an opportunity to engage, and each attack may not result in a “hit,” much less the disabling or destruction of a carrier. However, the modeling indicates that the risks to U.S. carriers are substantial and rising.

U.S. Mitigation Options

The U.S. military has a variety of means to mitigate specific threats, and it will improve them over time. New counterspace and cyber capabilities may enable U.S. forces to degrade China’s space-based ISR, as well as its over-the-horizon radar. The U.S. Navy is almost certainly working on technical counters to China’s budding anti-ship ballistic-missile threat, both through kinetic ballistic-missile defenses and, perhaps more importantly, ways to defeat Chinese weapons sensors. Aircraft carriers can provide their own defensive combat air patrols to defeat the threat from enemy aircraft, and the United States is acquiring more and better anti-submarine warfare assets.

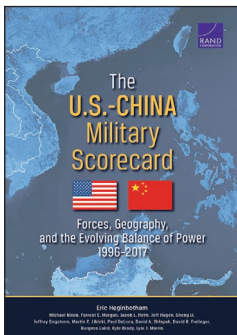
Nevertheless, given growing threats from China’s submarines, as well as China’s increasingly capable strike aircraft and anti-ship missiles, U.S. carriers may be held farther from the Chinese coast, particularly during the early stages of a conflict. This will reduce the number of U.S. naval aircraft in the fight, as these aircraft will have to traverse greater distances and will therefore spend less time on station. It will also increase the demand for U.S. Air Force tanker aircraft to refuel them. Increased tanker demand will, in turn, place further stress on available U.S. basing, which may itself be under threat from ballistic and cruise missile attack.

Further reading:

Tallying the U.S.-China Military Scorecard: Relative Capabilities and the Balance of Power, 1996–2017, RB-9858/1-AF (available at www.rand.org/t/RB9858z1)

Chinese Attacks on Air Bases in Asia: An Assessment of Relative Capabilities, 1996–2017, RB-9858/2-AF (available at www.rand.org/t/RB9858z2)

U.S. and Chinese Air Superiority Capabilities: An Assessment of Relative Advantage, 1996–2017, RB-9858/3-AF (available at www.rand.org/t/RB9858z3)



This research brief describes work done for RAND Project AIR FORCE documented in *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996–2017*, by Eric Heginbotham, Michael Nixon, Forrest E. Morgan, Jacob L. Heim, Jeff Hagen, Sheng Li, Jeffrey Engstrom, Martin C. Libicki, Paul DeLuca, David A. Shlapak, David R. Frelinger, Burgess Laird, Kyle Brady, and Lyle J. Morris, RR-392-AF, 2015 (available at www.rand.org/t/RR392). The RAND Corporation is a nonprofit research institution that helps improve policy and decisionmaking through research and analysis. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors. RAND® is a registered trademark. © RAND 2015

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