

U.S. and Chinese Air Superiority Capabilities

An Assessment of Relative Advantage, 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 Air Superiority

This brief focuses on one area in which China has made rapid relative improvements: the ability to contest U.S. air superiority in an Asian conflict. Historically, PLA air forces have not posed much threat to neighboring countries. In the past two decades, however, China has rapidly modernized its airpower. Whereas in 1996 China had just taken delivery of its first batch of 24 fourth-generation fighters, it now operates more than 700. The United States, in the meantime, has added fifth-generation fighters to its inventory, and its fleet remains both more advanced and larger than China's. Balanced against the aggregate U.S. advantage, however, are geographic and situational factors: China would enjoy the advantages of proximity in most Asian conflict scenarios. It would be able to operate from far more bases, allowing it to bring more aircraft to bear in a conflict, and its vital assets would be both dispersed over much greater areas and hardened against attack. Moreover, the few U.S. air bases within close proximity would likely face Chinese missile attack, degrading their ability to support operations.

How would the evolution of Chinese and U.S. forces interact with other situational factors to affect the air superiority battle? To assess this question, the researchers modeled

Key findings:

Although the United States continues to maintain unparalleled air-to-air capabilities, the modernization of Chinese air forces, combined with the inherent difficulties of operating over long distances in the Asian theater, make it increasingly challenging for the United States to gain air superiority during the first days or weeks of a possible conflict with China.

air combat in four snapshot years between 1996 and 2017, in two scenarios at different distances from the Chinese coast: a Chinese invasion of Taiwan and a campaign over the Spratly Islands. For each scenario, they calculated the size of the U.S. force (in 72-aircraft wings) required in theater to achieve two possible U.S. objectives. The first and more demanding objective would be to maintain a continuous presence in allied airspace sufficient to defeat a surge of attacking Chinese aircraft. The second would be to destroy, over time, enough Chinese aircraft to convince PLA leaders to abandon the air campaign—a threshold set for analytical purposes at 50 percent of the Chinese air forces involved in the campaign. In the latter case, the researchers examined the requirements associated with gaining air superiority within seven days and 21 days.

Model inputs included publicly available performance parameters for different types of aircraft; the total number and type of aircraft involved; the effectiveness of the air-to-air weapons employed; the number, types, and locations of bases; estimated aircraft and crew availability rates; and flight times to and from combat areas. Some allowance was also made for U.S. advantages in pilot training. The results are not intended to predict the precise outcomes of a conflict. Rather, they offer a picture of the evolving balance of airpower, indicating the general scale of effort that would have been required in each of the snapshot years, as well as the direction and speed of change.

Assessing Sufficiency in Taiwan Scenario

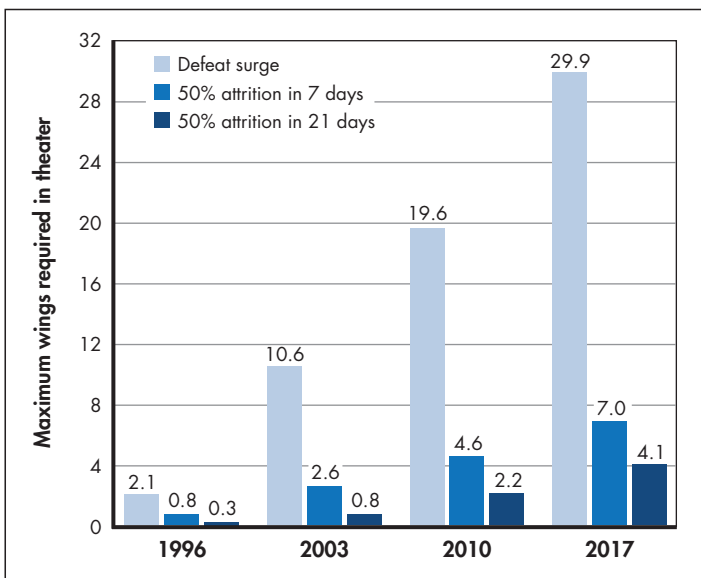
China's geographic advantages would be most pronounced in a Taiwan scenario, in which Chinese basing options are

plentiful and close to the likely combat areas and U.S. forces must operate over long distances from a more limited set of locations. This disparity would have been less relevant in 1996, when China operated a small force of antiquated aircraft, but it has become more important as China improves its air and missile forces.

Figure 1 illustrates the impact of the evolving balance of airpower. As shown in the light-shaded bars, only two U.S. wings would have been required in theater to maintain 24/7 air dominance from the outset of a conflict over Taiwan in 1996. By 2010, improvements in Chinese air forces and missile capabilities increase this requirement to between nine and 20 wings (depending on how far away U.S. forces must be based). The higher requirement exceeds the total number of U.S. fighter wings, and basing within range of operational areas would almost certainly have been insufficient to support even the smaller number (especially given the significant requirements for tanker basing). By 2010, achieving 24/7 air dominance at the outset of a conflict was, and remains, unsustainable.

The United States would have better prospects of prevailing in an attrition campaign designed to defeat a Chinese air offensive over time. Nevertheless, PLA Air Force modernization has made such a campaign more challenging. The number of wings required is shown as medium-shaded bars (seven days) and dark-shaded bars (21 days) in Figure 1. Even in the attrition case, the United States would face increasing difficulty meeting its objectives in 2017, as more aircraft would be required, and there would be fewer bases to offer safety from Chinese missiles.

Figure 1. Maximum U.S. Wings Required in Theater to Achieve Air Superiority in a Taiwan Conflict Scenario



The results should be understood in context. China cannot achieve air superiority in any of these cases, and U.S. fighters achieve high kill ratios throughout. Relaxing the 21-day time requirement would reduce U.S. in-theater force requirements to levels that might be supported more easily by the available basing infrastructure. However, until U.S. forces achieve air superiority, the PLA air forces would largely have a free hand in attacking targets in Taiwan. A ground campaign in Taiwan would likely be decided relatively quickly, and the inability of U.S. air forces to achieve air superiority during that time would deprive U.S. and friendly forces of much-needed air support.

Assessing Sufficiency in the Spratly Islands Scenario

The challenge to U.S. air superiority is less pronounced in the Spratly Islands scenario. While the modernization of China's air capability has progressively increased the U.S. forces required to prevail in such a contest, the islands are considerably farther from China than Taiwan. Geography would, therefore, largely work against China. Few Chinese fighters would have the range to conduct operations over the Spratly Islands without refueling in the 1996 and 2003 snapshot years.¹ By 2017, China could field a more substantial force of fighters and strike aircraft (including Su-27s, Su-30MKKs, and JH-7s, as well as H-6 bombers) against targets in this area, though most of these aircraft would still be operating near the limit of their range, and the total number would be restricted by the small (but growing) number of bases in the Guangzhou Military Region capable of supporting such operations.

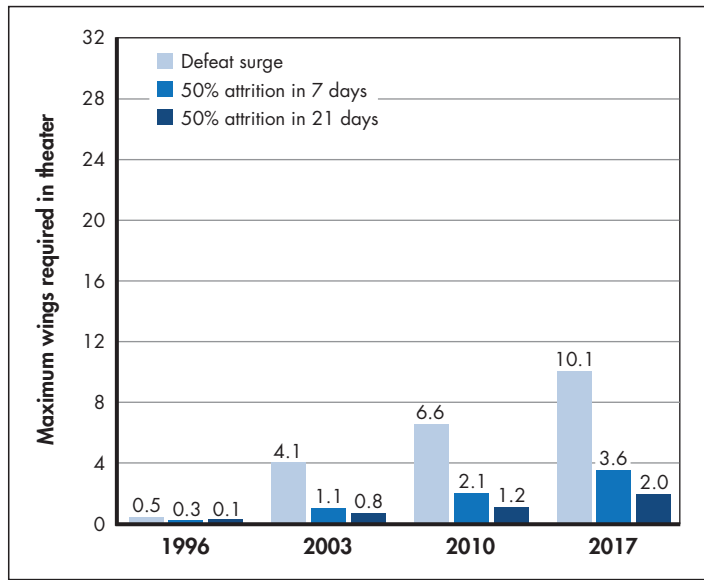
The modeling results, shown in Figure 2, suggest that, as in the Taiwan case, it would have been virtually impossible for the United States to maintain a decisive 24/7 presence from the outset of a conflict after 2010. However, the results also suggest that the United States would be able to achieve attrition-based air superiority in a relevant time frame even in the 2017 case, though the required in-theater force structure grows over time.

Conclusions

The United States continues to maintain unparalleled air-to-air capabilities. Even in the most challenging cases examined, the United States does not "lose" the war in the air. However, continuous improvements to Chinese air capabilities make it increasingly difficult for the United States to achieve air superiority within a politically and operationally effective time frame, especially in a scenario close to the Chinese mainland.

¹ The PLA has only a handful of tankers, which would probably be used to "top off" longer-range aircraft before they departed for contested airspace.

Figure 2. Maximum U.S. Wings Required in Theater to Achieve Air Superiority in a Spratly Islands Conflict Scenario



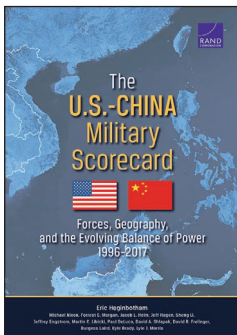
These developments also raise the probable cost of a war in terms of lives and equipment. In both scenarios examined, the United States could improve its results and reduce force requirements by attacking Chinese air bases, thereby reducing the number of adversary aircraft that can reach the fight. However, the decision to launch such attacks would require executive approval and, depending on circumstances, permission might not be forthcoming. Certainly, such attacks would be potentially escalatory. Regardless of U.S. action, China may also pursue a similar strategy against U.S. air bases, employing its large and sophisticated force of conventionally armed ballistic and cruise missiles. Overall, the results indicate that, in the face of PLA Air Force modernization, achieving air superiority early in a conflict is becoming increasingly difficult. Consequently, U.S. and partner ground and naval forces may have to operate with only limited air support for some period after the commencement of hostilities, should a conflict occur.

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)

Chinese Threats to U.S. Surface Ships: An Assessment of Relative Capabilities, 1996–2017, RB-9858/4-AF (available at www.rand.org/t/RB9858z4)



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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