

Seize the Technological High Ground for Success in Great-Power Competition

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Abstract

Beijing's crucial advantage in great-power competition with the United States is China's application of military and economic power in pursuit of advanced technology and capabilities. Over the past 30 years, China developed and fielded capabilities to counter US power and is now on a path to achieve technological dominance over the United States by obtaining leap-ahead technologies through a continued focus on defeating US systems and the fusion of China's civilian and military economic sectors. Despite China's military and economic capacity and bold plans, Beijing lacks partners and allies. The United States must expand its relationships with other nations to include research and development of new capabilities, not merely transferring technology. By leveraging its partners' broad and diverse technology investments and talents, the United States can mass research-and-development efforts to counter China's high-tech breakout and avoid being outgunned and outmatched.

The rollout of the B-21 was not a day of celebration but one of caution. While the US Air Force boasted of another multi-billion-dollar program grounded in decades-old methods of warfare, the Chinese continued their focused efforts to counter the United States through new ways and means of war. US history provides a warning about similar situations. In his discussion of the slaughter visited upon the retreating British army through the New England countryside in April 1775, the British general Lord Percy described the skill and perseverance of the colonists. The militiamen knew their adversary, understood his weaknesses, and ruthlessly exploited those vulnerabilities.¹ Much like the American colonists of 200 years ago, the Chinese studied US capabilities and now seek to counter and exceed them in new and unexpected ways. In China's competition with the United States, its crucial advantage is its application of military and economic power in pursuit of advanced technology and capabilities. China's singular focus on countering US military capabilities enables it to field systems that negate US advantages. Beijing seeks technical dominance over the United

¹ Derek W. Beck, *Igniting the American Revolution: 1773–1775* (Naperville, IL: Sourcebooks, 2015), 216.

States by continuing this focus and blending its military and economic instruments of power through military-civil fusion (MCF).

However, China is primarily alone in its efforts, which puts it at a disadvantage in its competition with the United States. Beijing neglects the value of diplomatic partnerships, whose diversity provides value through shared technological development and strategic relationships.

Military acquisition decisions are crucial for a nation's success in great-power competition. National leaders must allocate economic resources wisely to maximize their return on investment. Appropriate focus on threats is necessary to ensure a nation's development efforts are orientated against the correct threat and receive adequate investment to deliver effective capabilities.

For more than three decades, China has concentrated its technology and capability development efforts on countering the United States, consistent with Adrea Gilli and Mauro Gilli's description of state military-technical competition where nations "devise countermeasures and counter-innovations to limit, and possibly eliminate, the advantage their enemy derives from its innovations."² As early as 1991, Chinese military leaders recognized how far they lagged behind the United States in technology. Following the Taiwan Straits crisis of 1996, Chinese military planners initiated efforts to modernize their forces and specifically "deter, delay, or defeat US military forces," according to Phillip C. Saunders.³ Anthony Cordesman's analysis of the 2013 and 2015 Chinese defense white papers shows how China recognized the significant threat posed by military technology competition with the United States and directed broad modernization efforts to address it.⁴ This intense focus on the United States as a threat prevents shifts in investment priorities which can affect many US development efforts. The current US *National Security Strategy* directs the Department of Defense (DOD) to counter China, Russia, climate change, and other threats, making it necessary for the DOD to adjust funding and refocus investments.⁵ However, investment stability is vital to the success of technology and capability development. The Department of the Air Force's Rapid Capabilities Office (DAFRCO), a specialized program office tasked with delivering the most advanced and sensitive capabilities

² Andrea Gilli and Mauro Gilli, "Why China Has Not Caught Up Yet: Military-Technological Superiority and the Limits of Imitation, Reverse Engineering, and Cyber Espionage," *International Security* 43, no. 3 (Winter 2018/19), 145, <https://doi.org/>.

³ Phillip C. Saunders, "China's Global Military-Security Interactions," in *China and the World*, ed. David Shambaugh (New York: Oxford University Press, 2020), 186, <https://doi.org/>.

⁴ Anthony H. Cordesman, *Chinese Strategy and Military Modernization in 2016: A Comparative Analysis* (Washington, DC: Center for Strategic and International Studies, 2016), 37–38 and 50–54.

⁵ *National Security Strategy* (Washington, DC: The White House, October 2022), 23–31.

to the DAF, explicitly mentions the criticality of funding stability as a fundamental operating principle.⁶ Unfortunately, the DAFRCO is the exception. China likely applied the DAFRCO principle; it maintained focus on countering US advantages and deployed a robust, regional integrated air defense system (IADS) intended to deny access and impose high costs on an attacker.⁷

With a credible counterbalance to US technology presently fielded, Beijing is pursuing an ambition to surpass US capabilities. Rather than solely countering US technology, China seeks to gain a “first mover advantage,” as described by Dr. Jared McKinney, by entering new technological domains where the United States will need to catch up.⁸ The phrase “Big Hairy Audacious Goal” (BHAG), coined by management writer Jim Collins, describes a “huge, daunting challenge”—a lofty, nearly impossible goal designed to drive a team to achieve beyond its perceived limits.⁹ China is adopting the BHAG concept to focus its military development on leap-ahead technology. Instead of aiming for parity with the United States, China is striving for technological BHAGs to achieve military dominance and establish a strategic advantage over the United States.

In his 28 May 2021 Science and Technology Speech, President Xi Jinping made it clear that China intends to become a dominant power by innovating and seeking the “commanding heights” of technology and development. The Chinese *Science of Military Strategy* directs Beijing to pursue paradigm-changing technologies and capabilities across domains, which will not offer mere incremental improvements in military capability but change the conflict landscape.¹⁰ These capabilities will provide the Chinese military with an asymmetric advantage over the United States akin to how the longbow or machine gun altered warfare in their respective eras. China’s focus on artificial intelligence, quantum computing, electronic warfare, and informatized warfare can combine to form a network capable of inflicting severe costs on US airpower. For example, a quantum-enabled network could simultaneously fuse multi-domain sensor data, conduct cognitive electronic warfare, and cue long-range missiles, rendering the most-advanced USAF platforms ineffective and canceling decades and billions of dollars of US

⁶ Heather Wilson, et al., *Charter for the Air Force Rapid Capabilities Office* (Pentagon, Washington DC, 13 August 2018), 2-3.

⁷ Office of the Secretary of Defense, *Military and Security Developments Involving the People’s Republic of China* (Washington, DC: DOD, 2022), 82.

⁸ Jared M. McKinney, “Emerging Strategic Domains: Space, Network, Deep Sea, Polar Regions, Biology, Intelligence” (lecture, Air War College, Maxwell AFB, Alabama, 9 December 2022).

⁹ James C. Collins and Jerry I. Porras, *Built to Last: Successful Habits of Visionary Companies* (New York: Collins, 2009), <https://www.jimcollins.com/>.

¹⁰ McKinney, “Emerging Strategic Domains,” 5–22.

research and development (R&D). By revealing such capabilities, Beijing could send a deterrence message that China can impose high costs on the US military. Alternatively, China could keep such capabilities secret and only reveal them in the event of armed conflict, but the result would be the same: China could cripple the advanced platforms that form the backbone of the US way of war. To prevent this, the United States must reduce its reliance on well-known capabilities and focus investments on achieving breakthroughs in revolutionary technologies before China gains the advantage.

China is aggressively pursuing breakthrough technologies to establish a new playing field where it leads and can negate US advantages. The country's investments in R&D and its alignment of civilian and military interests through MCF provide a whole-of-nation construct where developments and requirements in one sector support the other. A key aspect of MCF is the Military-Civil Coordinated Technology Innovation System, which according to the DOD, "focuses on fusing innovations and advances in basic and applied research" and promotes "civilian and military R&D in advanced dual-use technologies."¹¹

China's R&D investment has been growing rapidly, accounting for nearly USD 100 billion more growth in global R&D investment than the United States since 2000, according to the National Science Board. China invested USD 525.7 billion in R&D in 2019, compared to the United States' USD 668.4 billion. However, the vast majority, 74.5 percent, of US R&D expenditures are in the private sector, where most of the funding supports commercial interests and may not be accessible to the DOD. In contrast, all R&D funding in China supports MCF requirements, without any delineation between civilian and military applications. Furthermore, China's R&D investment focuses mainly on experimental development, which accounts for 83 percent of its R&D spending, the highest in the world.¹² This suggests that China is betting on different technology areas, hoping some will deliver revolutionary capabilities such as quantum computing and AI that can provide an asymmetric military advantage. This holistic picture of China's substantial R&D investment aligns with McKinney's assertion that China is pursuing paradigm-changing technologies across domains to gain an advantage over the United States.¹³

¹¹ Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China*, 27–29.

¹² National Science Board, National Science Foundation, *Research and Development: U.S. Trends and International Comparisons. Science and Engineering Indicators 2022* (Alexandria, VA, 2022), 27–35, <https://ncses.nsf.gov/>.

¹³ McKinney, "Emerging Strategic Domains," 25.

One critical factor for accurately understanding the accurate global R&D investment picture is relationships. While the data may suggest that China is making significant strides in pursuing cutting-edge technologies while the United States falls behind, it is important to note that the United States collaborates with its allies and partners and vice versa, which creates a multiplier effect through shared investments and diversity of knowledge. The following table from the National Science Board includes the total R&D investment rates and percentage of GDP for several of our allies and partners.¹⁴

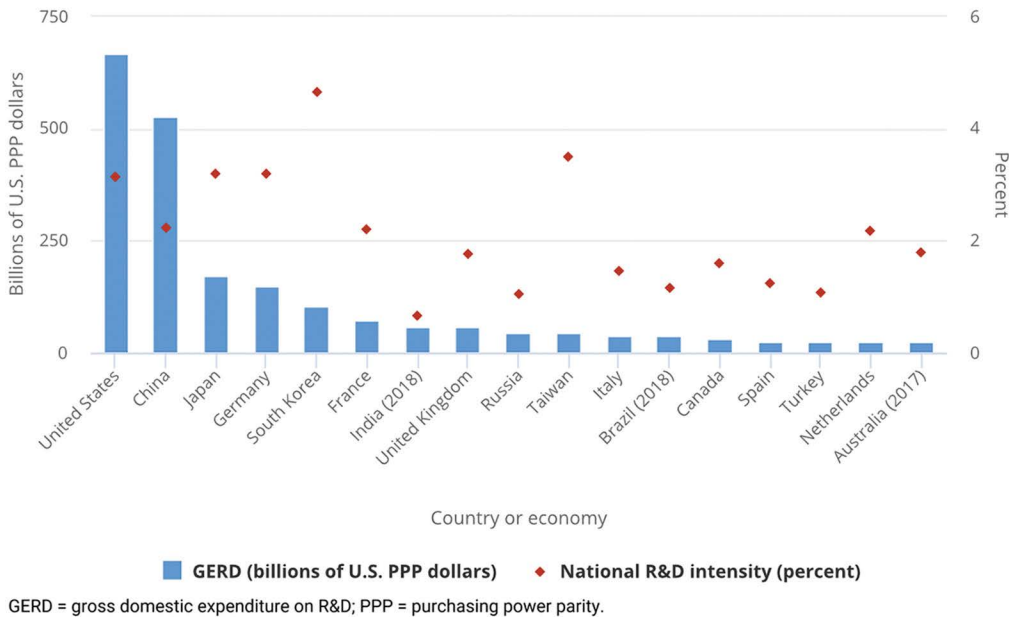


Figure 1. GERD and R&D intensity for world’s top 17 R&D-performing countries and economies: 2019 or most recent data year

This data highlights an opportunity for the United States and its allies to leverage their combined R&D investments to address current technical challenges and counter China’s increasing R&D expenditures. By combining the R&D investments of Japan, Germany, South Korea, France, and the United Kingdom, the total investment exceeds China’s R&D spending—(USD 525.7 billion versus USD 554.1 billion).¹⁵ A united front of technological investment could double the available R&D funds to counter China. Additionally, such a coalition could benefit from the unique technological advantages or specialized areas of expertise

¹⁴ National Science Board, “Research and Development,” 24.

¹⁵ National Science Board, “Research and Development,” 24.

possessed by partner nations, such as Australian radars and electric Japanese submarines, giving them an edge over China. In contrast, China has no such option to access external technological advancements or expertise.

Beijing's technology and capability development are moving in a distinctly Chinese direction. In contrast, the United States has a long history of R&D partnerships with many of its allies and partners, which is particularly important as modern military systems become more complex and costly. In late 2020, Dr. Will Roper, Assistant Secretary of the Air Force for Acquisitions, Technology, and Logistics, engaged in several bilateral discussions with Royal Air Force (RAF) leadership, crafting a partnership for developing a sixth-generation fighter.¹⁶ The cost of developing a new fighter aircraft and its associated payloads is exorbitant. Additionally, the US defense industrial base has shrunk, reducing competition and innovation. Dr. Roper and the RAF leaders sought to expand the competitive landscape by creating an environment where US and UK companies could compete for parts of the aircraft development, and both nations could share technical information to assist in their respective aircraft design. This approach would combine the R&D investments of both nations, leverage their unique technical knowledge, and create a more affordable system through increased competition and cost-sharing.

China, on the other hand, appears to lack many similar developmental partnerships, though the joint fighter it has developed with Pakistan is an exception. While Beijing's MCF enables China to leverage commercial and military resources, the costs and the cognitive capacity are still solely China's. Moreover, according to Elsa Kania and Lorand Laskai, "(o)ver the past 30 years, China's defense sector has been primarily dominated by sclerotic state-owned enterprises that remain walled off from the country's dynamic commercial economy." It is reasonable to conclude that China lacks rich sources of creativity and innovation offered by partnerships with other nations.¹⁷

Developmental partnerships are crucial for enabling coalition war fighting through standard system baselines and enhancing diplomatic relationships. However, China has few true allies, aside from recent overtures with Russia and Beijing's efforts to buy friends and influence through the Belt and Road Initiative (BRI). China's aggressive diplomatic activities focus on compelling other nations' compliance rather than earning trust and building relationships. Katherine Mor-

¹⁶ I served as Dr. Roper's military assistant from July 2020 until his departure in January 2021. I personally attended the meetings with the RAF on sixth-generation collaboration.

¹⁷ Elsa B. Kania and Lorand Laskai, "Myths and Realities of China's Military-Civil Fusion Strategy" (Washington, DC: Center for a New American Security, January 2021), 4.

ton describes Xi's motivations in global governance as focused on advancing China's interests specifically, "1. To defend China's interests on a global scale, 2. To strengthen China's strategic role in institution building, 3. To broaden China's normative voice as a means of legitimating its role as a global power."¹⁸ While all nations act in their self-interests, the motivations, Morton's description highlights China's singular focus on maximizing its own benefits without much consideration for other nations.

China's lack of interest in building mutually beneficial relationships with other nations is further demonstrated through its corrupt and aggressive pursuit of influence in international organizations and BRI investments. For instance, Chinese officials may have bribed and coerced Cambodian officials in 2012 when Phnom Penh held the chairmanship of the Association of Southeast Asian Nations (ASEAN) to prevent bloc from issuing any condemnation of China's action in the South China Sea.¹⁹ Additionally, Beijing acquired contracts with the Philippines in an unlawful manner.²⁰ These blatant, aggressive, and corrupt actions diminish China's legitimacy on the international stage and give it a reputation as an unreliable partner. They reinforce the perception that Beijing's diplomatic efforts seek to maximize China's benefit while disregarding other nations' interests.

China's diplomatic instrument of power also lacks a unifying vision that transcends borders and draws others to its orbit; it has no constructivist ideal or value to attract support. In contrast, the United States shares a vision with its allies and partners that represents the ideals of freedom and self-determination, transcending borders and firmly uniting allies and partners in shared goals and sacrifice. China exploits other nations and offers a vision of authoritarianism and dependence. Consequently, Beijing is likely to find itself alone in its competition with the United States, while Washington can leverage the support and resources of its many allies and partners.

China aims to gain an advantage in great-power competition by focusing on leap-ahead technologies, rather than competing with the United States on the present-day playing field where it is playing catch-up. Beijing's MCF strategy combines its military and economic resources to achieve China's goals and deliver asymmetric capabilities. However, China's crucial weakness is its lack of allies and

¹⁸ Katherine Morton, "China's Global Governance Interactions," in *China and the World*, ed. David Shambaugh (New York: Oxford University Press, 2020), 164, <https://doi.org/>.

¹⁹ "China Gives Cambodia Aid and Thanks for ASEAN Help," *Reuters*, 4 September 2012, <https://www.reuters.com/>.

²⁰ "World Bank Applies 2009 Debarment to China Communications Construction Company Limited for Fraud in Philippines Roads Project," World Bank, 29 July 2011, <https://www.worldbank.org/>.

partners. Without diverse technical talent and cognitive diversity that come from diplomatic relations built on shared values and mutual respect, China may struggle to match the creativity and innovation of the United States and US allies and partners. In contrast, Washington has the advantage of numerous beneficial relationships with other countries. By focusing on developing new technology together rather than simply transferring US technology, the combination of raw investment dollars and diverse technical talent can unlock a powerful competitive tool. Through these relationships, the US can improve its thinking, advance research, and outpace China in the race for leap-ahead technologies before B-21s end up like the Red Coats on that April afternoon in 1775. ✪

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