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REPORT

On geopolitics and innovation:

How the military technology race between the United States and China will shape global security

By Carlos Cantafio Apitz and Branka Marijan

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Introduction

The intensifying rivalry between the United States and China is continuing to fuel the speedy innovation and adoption of emerging military technologies (EMTs). Forecasting the effects of these new technologies on warfare and strategic stability is difficult because they depend on many factors. These include the speed of technological progress; the ways in which new technologies are deployed by existing military platforms and strategies; the potential interplay between emerging technologies; and the degree to which domestic forces/national policies and international law shape their progress, integration, and application.

The United States and China have steadily increased military spending in the most recent five-year period (2017 to 2021), reaching in 2021 an estimated U.S.$770B and $270B, respectively. The budget request for the U.S. Department of Defense (DOD) of approximately $840B for fiscal year 2024 is in great part driven by this rivalry. Indeed, U.S. Secretary of Defense Lloyd J. Austin III stated that the request was based on "a strategy-driven budget – and one driven by the seriousness of our strategic competition with the People's Republic of China."

The cited estimates of China's military spending are believed to be incomplete and lower than actual spending. This is in part due to exclusion of some programs, such as certain military research, from the official defence budget and partly because of the lack of public transparency regarding China's military expenditures. Still, it is clear that recent increases in China's defence budgets are driven by what it perceives to be "escalating threats" and "external attempts to suppress and contain China."

China has also sought to become less dependent on critical components from the United States and its allies as it seeks "global technological supremacy." This quest for independence can be seen in the focus of its military-civil fusion strategy on the dual-use nature of emerging technologies such as artificial intelligence (AI). The United States and its allies have similarly sought to move away from reliance on China for components and have even sought to restrict China's access to certain technologies, notably semiconductors. Technological primacy underlies the latest American and Chinese developments, with the United States seeking primacy retention and China primacy obtention.

This commentary will (1) briefly explore great power competition as a cause and consequence of the development of emerging military technologies and (2) highlight the need for greater bilateral and international cooperation, regulation, and oversight to manage this growing arms race.

Technological decoupling and global fragmentation

The rise of great power competition has caused techno-nationalist ideas to dominate defence thinking. Increasingly, new technology is viewed as an element of an interstate geostrategic competition rather than a market commodity. While technology has long featured in geostrategic considerations, the link between dominance in new technology and dominance of the global order has intensified. This national security narrative has resulted in a progressive decoupling of American and Chinese technology and innovation ecosystems (e.g., tighter controls on sharing strategic technology and knowledge). Rivalry and the resulting decoupling appear to have fostered an intensified arms race, with the gap between technological developments and regulation, both domestic and international, expanding at an accelerated pace.

The result could be adverse effects in other policy arenas (e.g., climate change technology collaboration). Scientists have already expressed concern about the impact of geopolitical tensions on research and collaboration between communities in the United States and China. The International Monetary Fund has also noted that tensions between the great powers would result in a cut of two per cent to the global gross domestic product and harm developing economies the most.

Table 1 (see Annex) provides a high-level overview of recent American and Chinese trends in research and development (R&D), focusing on six EMT clusters: AI and big data analytics, autonomy & robotics, novel delivery technologies, advanced materials & manufacturing, biomedical sciences & human augmentation, and quantum technologies. These clusters grew out of the collection of data points from 20 reports by North American and European actors from the private, public, and nonprofit sectors on emerging technologies and future warfare (for more information see our recent report The future of global conflict: A synthesis of contextual and technological perspectives). As Table 1 shows, the investments, reactive and proactive, of both China and the United States appear to be fueling an arms competition in all the clusters.

While both countries are increasing investments in military R&D of EMTs, each approach has its own dynamic.

The U.S. approach

In the 21st century, the United States has transformed its approach to researching, developing, financing, and commercializing military technology. While the DOD used to function as a centralized R&D and financing agency for military technologies, actors in the American private sector are now playing a more important role in directing technology investments. The U.S. government's share of global R&D fell from 36 per cent in 1960 to 3.1 per cent in 2019.

Private American companies, driven by consumer demand, are guiding the focus of technology R&D. This attribute of the U.S. ecosystem has security implications, with the government having to dedicate added resources to understand the changing domestic technology landscape and to guard against information leakage in an increasingly decentralized sector.

At the same time, major American technology companies are playing an outsized role in shaping policy, notably on AI regulations, through their extensive lobbying efforts. Lobbyists argue that tighter regulations on tech companies would make the United States less competitive than China.

Despite lobbying by major corporations, most AI contracts from the U.S. DOD are distributed among smaller companies and startups. If a greater concentration of contracts were to go to a few companies, any relaxation of regulations could further an AI arms contest with China. U.S. government spending on AI and related technologies is likely to increase and the DOD will continue to push for a greater share of these funds.

The United States also actively seeks to shape international rules and regulations on new technologies through global coalitions and bilateral conversations with allies, such as the Quadrilateral Security Dialogue, AUKUS, and the European Union. This approach likely provides the United States with an asymmetric edge, as could be seen when recent export controls of advanced computer chip hardware, including semiconductors, were enacted by the United States in 2022 and emulated by allies, notably Japan and the Netherlands. The three countries effectively control about 90 per cent of the equipment required to manufacture advanced chips, seriously impacting China's ability to access the chips needed for AI and quantum technology advancements.

China's approach

China's EMT R&D approach is heavily influenced by its military-civil fusion strategy, which allows the Chinese government to directly influence the strategic development of technology. For example, China's stated strategic technological priorities – AI and autonomous systems – support the country's military vision of "intelligentized" warfare. The proliferation of Chinese technology is primarily associated with Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) capabilities. Such technologies are embedded in its Belt and Road Initiative. Some 80 countries use Chinese technology for policing and surveillance and more than 30 countries have received training from China on leveraging AI tools for censorship and surveillance.

In response to U.S. controls on semiconductors, China blocked all Chinese corporate mergers with U.S. semiconductor partners, impacting several American companies that had identified Chinese companies that were developing semiconductors that would be important to future technological advancements. China also blocked the purchase of chips for critical infrastructure from U.S. company Micron on cybersecurity grounds.

The announcement of a strategic Chinese-Russian partnership on emerging technologies, particularly AI, has raised some concern over its impact on the United States and its allies. However, even though the AI partnership between China and Russia seems to be expanding, its impact on investments in AI development is not currently significant. Still, the ability of the partners to shape norms and efforts on responsible use of AI by militaries is not yet known. China is widely perceived as a more challenging contender than Russia in the field of AI development.

Ultimately, both the United States and China are competing to take a leadership role in the development of global norms, governance, and standards on new technology. However, the ability of either country to influence global norms will depend on the reach of their technology as well as a number of other political and economic factors. The result could be more global technological fragmentation, with each great power potentially exerting greatest authority on the norms and regulations applied to the technologies they export.

Call to action

The decoupling of American and Chinese technologies and the increasing fragmentation of the global technology sector will have predictable and unpredictable effects on any international attempt to develop a global EMT governance framework. Renewed efforts to govern EMTs are critical to sustain global security, stability, and economic growth.

Deteriorating bilateral relations between the United States and China demand attention and remediation. The global community should encourage greater transparency, discussion, and cooperation between the two states. While certain technologies are of great interest for national security, the United States and China should acknowledge that their competition may make the resolution of common problems more difficult. The integration of technology into global economic, security, and political spheres certainly compounds already intense great-power dynamics. Anything less than urgent action to establish global EMT governance could result in irreparable harm.

Annex

Table 1. Breakdown of competition between the United States and China by Emerging Military Technology Cluster

ACTOR / EMT CLUSTER	AI & BIG DATA ANALYTICS	NOVEL DELIVERY TECHNOLOGIES	ADV. MATERIALS & MANUFACTURING
 UNITED STATES	The DOD's unclassified AI investments are expected to reach U.S.$1.1B in FY2023 (2x the 2016 amount), with the department working on ~700 projects. Similarly, the DOD established a Joint AI Center (JAIC) to explore and develop the DOD's AI capabilities. As the technology develops, concerns with ethical uses of AI may hamper development of militarized AI.	It is reported that the United States is not conducting research on nuclear-carrying hypersonic weapons, but Russia and China are. DOD research is focusing on accuracy and precision of hypersonic weapons. Apparently, internal debates on how valuable hypersonics are for the United States may slow down the U.S. ability to lead in this technology.	The United States (and Japan) have the most filed patents. However, the annual number of U.S. patents has been in decline since 2015, while other world regions have seen the opposite trend. Such a decline could be driven by a focus on quality and by an increasing reliance on trade secrets rather than patenting to protect intellectual property.
 CHINA	Seen as the main competitor to the United States in AI, China has focused its R&D on facial recognition, cyber operations, and swarm technologies. China's AI approach differs from the American by focusing on industry-military linkages that give the Chinese government the direct means to guide AI development priorities.	China is leading in R&D in directed energy weapons (DEW) and hypersonics. According to the U.S. Defense Intelligence Agency, China may already have the capability to employ laser systems to damage low-orbit space-based satellite sensors. Intelligence also suggests that China has tested intercontinental-range hypersonic vehicles.	China has a significant lead in academic publications on advanced materials and manufacturing, which reflects its national strategy of investing in solar cells and battery technologies. China wants to become self-sufficient in certain materials subsectors, particularly those critical to technology development.

AUTONOMY & ROBOTICS	BIOMED & HUMAN AUGMENTATION	QUANTUM TECHNOLOGIES
As far as is known, the United States has no lethal autonomous weapons systems (LAWS) in its inventory and has strict rules on changes to any system's operating status. These regulations require a post-change review of a system to ensure compliance with safety standards. However, the United States has indicated that it will likely develop LAWS if competitors do so.	Unclassified U.S. biotech projects appear to focus on "readiness, resilience, and recovery." However, the United States has previously researched human augmentation applications. Following the COVID pandemic, the Biden administration launched the National Biodefense Strategy, which is likely to generate funding options for additional research.	Priority has been given to R&D on quantum-resistant cryptography, as analysts believe quantum-enabled decryption could be developed between 2030-2040. The Navy, Air Force, and Space Force now have quantum-focused research organizations that engage both public- and private-sector actors. The Defense Advanced Research Projects Agency (DARPA) also funds a portfolio of different quantum technology programs.
U.S. officials have claimed that Chinese manufacturers have advertised weapons with the ability to "select and engage targets autonomously." China does not currently prohibit development of LAWS.	China's Made in China 2025 initiative highlights biotechnology as a key national priority. R&D has centred on genetic testing and precision medicine. There is limited open-source information on China's biotech-military R&D; however, there is a strong civil-military interconnectedness. The military has funded human performance enhancements and synthetic biology.	Most advancements have been driven by academia; however, the government has expressed its intent to leverage quantum technologies for military applications. As a major quantum player, China launched the first satellite to enable quantum encrypted communications and has completed quantum networks across several of its major cities.

Source: Perspectives from the Office of the Deputy Assistant Secretary of the Army, 2019 and Sayler, 2022

Project Ploughshares is a Canadian peace research institute with a focus on disarmament efforts and international security, specifically related to the arms trade, emerging military and security technologies, nuclear weapons, and outer space.

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