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Preserving U.S. Military Advantage Amid Rapid Technological Change

BY

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I. A Shifting Global Innovation Landscape

Chairman Reed, Ranking Member Wicker, distinguished Senators, thank you for having me here today.

We live in a period of tremendous technological change. This disruption creates opportunities for the United States but also for our adversaries. To sustain its battlefield advantage, the U.S. military must adopt technology faster than its competitors. In many cases, the Defense Department does not need to invent new technologies. The bulk of technological innovation is occurring outside the Department of Defense (DoD), a dramatic change from fifty years ago. DoD must prioritize spinning-in commercial technologies and harnessing them for military advantage. This contest to rapidly adopt commercial technologies is, unfortunately, an all-too-level playing field with our competitors. China, in particular, has access to world-class technology companies, and the People's Liberation Army (PLA) is working to "intelligentize" its forces.[1] The Defense Department needs significant institutional change to keep pace with the speed of technological innovation. Without these changes, we risk falling behind competitors, and the U.S. military being unprepared in a future conflict.

The core problem the Defense Department faces is that it is attempting to compete in 21st century technologies using a 20th century bureaucracy. The technology innovation landscape has changed dramatically in the past half century, but DoD's institutions have not kept up. It is not merely that technology itself has advanced. That alone would be manageable. The problem is that the role the Defense Department plays in the tech innovation ecosystem has changed, but the DoD has not yet sufficiently adapted to this new reality.

The Defense Department used to be the main driver of global innovation. But not anymore. In 1960, the Defense Department alone controlled 36 percent of global research and development (R&D) spending. The Defense Department could singlehandedly drive the shape of technological evolution around the world and for future wars. DoD could make bets that others had to respond to. Today, this dynamic has reversed. DoD controls only 3 percent of global R&D. Two trends have driven this shift. First, the federal government's share of U.S. domestic R&D has fallen from two-thirds of national R&D to less than one quarter, with private businesses picking up the slack. This pattern has been mirrored globally. In 1960, the United States as a nation accounted for nearly 70 percent of global R&D. Today, the U.S. portion of global R&D has fallen to 30 percent.[2] The combination of these trends in the commercialization and globalization of research and development has dramatically changed the role the Defense Department plays in technology development. Instead of being a trend-setter, the DoD is forced to react to technology trends exogenous to the defense industry.

II. Exponential Growth in Information Technologies

The dominant trend in global technology innovation is the information revolution. Network connectivity and bandwidth, big data, artificial intelligence and machine learning, genomics, internet of things devices, and computing hardware are all advancing at literal exponential rates. To give just one example, the amount of computing hardware used to train cutting-edge machine learning systems, such as large language models like ChatGPT, has grown ten billionfold since 2010 and is doubling every six months.[3] This is much faster than the historical 24-month doubling in chip performance associated with Moore's Law.[4] This has dramatic implications for the military. Few other technologies are advancing this quickly. Missiles are not ten billion times faster than they were in 2010. Stealth aircraft are not ten billion times stealthier. Yet information technologies are advancing at a breathtaking pace, creating new opportunities for military applications. And these technologies are so widely available, coming out of a highly globalized, commercially-driven R&D ecosystem, that competitors have similar opportunities to develop and field these technologies.

The rapid pace of advancement in information technologies suggests these are likely to have the most transformative effect on warfare in the coming decades. DoD should prioritize investments in capabilities that are riding these exponential curves. Autonomy, robotics, advanced sensors, communications networks, data processing, automated decision aids, AI and machine learning, computing hardware, cloud computing, electronic warfare, cyber operations, synthetic biology, and genomics are all examples of the kinds of technologies and capabilities that benefit from advances in information technology.

We can already see evidence of this dynamic in the war in Ukraine. Small, commercially available drones have transformed the battlespace, with both Russia and Ukraine using them for reconnaissance and strikes. Increasingly, these drones use AI tools such as machine learning image classifiers to identify objects. Counter-drone electronic warfare systems and jammers have also increased in response.

Our adversaries will capitalize on these technologies. The only question is whether the United States also competes or falls behind.

III. The Need for Institutional Change

How should the Defense Department adapt to this new reality?

Increased defense R&D spending is to be welcomed but cannot fundamentally change the diminished role that U.S. defense spending plays in the global technology ecosystem today. Doubling or even tripling defense R&D spending would still mean that 90 percent of tech innovation occurs outside the defense sector. The most urgent and important priority is for DoD to improve its processes for bringing commercial technology into the Department.

But it is not enough for DoD to buy commercial technology. It must also move faster to keep pace with the speed of technological change. The decades-long time horizon on which DoD typically develops weapon systems is too slow for information technology and will result in systems being out-of-date before they are fielded.[5]

DoD has made some progress on this front. Since 2015, DoD has created a raft of new, innovation-focused organizations, including the Defense Innovation Unit (DIU), Chief Digital and Artificial Intelligence Office (CDAO), Air Force Works (AFWERX), Special Operations Forces Works (SOFWERX), and many other organizations. Many of these have yielded tangible successes.[6] DoD has also improved its ability to bring on non-traditional companies and use more flexible contracting vehicles, such as other transaction authority.[7]

Yet DoD has often struggled to innovate quickly at scale. DoD must move beyond bespoke solutions to one-off problems and scale commercial tech adoption across an $800 billion enterprise. The Department's new Replicator initiative is a promising sign of the importance that senior Department leadership is placing on this effort and will be a crucial test of the Department's ability to innovate quickly at scale.[8]

There is no time to waste. U.S. competitors are also innovating. The PLA is similarly experimenting with new organizations to bring in commercial technology. In 2018, the PLA's Central Military Commission Science and Technology Commission created a "rapid response small group" in Shenzhen to adopt commercial technologies, which some Chinese commentators referred to as "China's DIUx."[9] China also has access to world class technologies, and the United States will have to innovate faster to stay ahead.

DoD will need Congress's support to move fast, be flexible, experiment with new technologies, engage non-traditional defense companies, and take risks.

Thank you.

Appendix A: Additional Reading

Paul Scharre and Ainikki Riikonen, *Defense Technology Strategy* (Center for a New American Security, November 17, 2020), https://www.cnas.org/publications/reports/defense-technology-strategy.

Obstacles and Opportunities for Transformative Change: Testimony Before the House Committee on Armed Services Subcommittee on Cyber, Information Technologies, and Innovation, 118th Cong. (October 19, 2023) (statement of Paul Scharre, Executive Vice President and Director of Studies, Center for a New American Security) https://armedservices.house.gov/sites/republicans.armedservices.house.gov/files/Paul Scharre Testimony_HASC-CITI_10.19.23.pdf.

Appendix B: Curriculum Vitae

Paul Scharre is the Executive Vice President and Director of Studies at CNAS. He is the award-winning author of *Four Battlegrounds: Power in the Age of Artificial Intelligence.* His first book, *Army of None: Autonomous Weapons and the Future of War*, won the 2019 Colby Award, was named one of Bill Gates' top five books of 2018, and was named by *The Economist* one of the top five books to understand modern warfare. TIME magazine named him in 2023 as one of the "100 most influential people in AI."

Scharre previously worked in the Office of the Secretary of Defense (OSD) where he played a leading role in establishing policies on unmanned and autonomous systems and emerging weapons technologies. He led the Department of Defense (DoD) working group that drafted DoD Directive 3000.09, establishing the department's policies on autonomy in weapon systems. He also led DoD efforts to establish policies on intelligence, surveillance, and reconnaissance programs and directed energy technologies. Scharre was involved in the drafting of policy guidance in the 2012 Defense Strategic Guidance, 2010 Quadrennial Defense Review, and secretary-level planning guidance.

Prior to joining OSD, Scharre served as a special operations reconnaissance team leader in the Army's 3rd Ranger Battalion and completed multiple tours to Iraq and Afghanistan. He is a graduate of the Army's Airborne, Ranger, and Sniper Schools and Honor Graduate of the 75th Ranger Regiment's Ranger Indoctrination Program.

Scharre has published articles in *The New York Times, The Wall Street Journal,* CNN*, TIME, Foreign Policy, Foreign Affairs, Politico,* and *USA Today,* and has appeared on CNN, MSNBC, Fox News, NPR, and the BBC. He has testified before the House and Senate Armed Services Committees and has presented at the United Nations, NATO, the Pentagon, the CIA, and other national security venues. He holds a PhD in war studies from King's College London and an M.A. in political economy and public policy and a B.S. in physics from Washington University in St. Louis.

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[1] Elsa B. Kania, *Chinese Military Innovation in Artificial Intelligence: Hearing of the U.S. Economic and Security Review Commission* (June 7, 2019) (statement by Elsa B. Kania, Adjunct Senior Fellow, Center for a New American Security) https://www.cnas.org/publications/congressional-testimony/chinese-military-innovation-in-artificial-intelligence.

[2] John F. Sargent Jr. and Marcy E. Gallo, "The Global Research and Development Landscape and Implications for the Department of Defense," R45403, Congressional Research Service, June 28, 2021, https://crsreports.congress.gov/product/pdf/R/R45403.

[3] Jaime Sevilla et al., *Compute Trends Across Three Eras of Machine Learning* (arXiv.org, March 9, 2022), https://arxiv.org/abs/2202.05924.

[4] Gordon E. Moore, "Cramming More Components onto Integrated Circuits," *Electronics* 38, no. 8 (April 19, 1965), https://ieeexplore.ieee.org/document/4785860.

[5] U.S. Government Accountability Office, *Weapons Systems Annual Assessment: Programs Are Not Consistently Implementing Practices That Can Help Accelerate Acquisition, June 2023, 28,* https://www.gao.gov/assets/gao-23-106059.pdf.

[6] Defense Innovation Unit, "DIU FY22 Transitions: Generating Meaningful Revenue Opportunities for Commercial Vendors," January 2023, https://assets.ctfassets.net/3nanhbfkr0pc/4uzqWzUNldUs54ukuzNOhj/3f49f33bf4401add2d16dbffb963eca8/FY_2022_DIU_Transitions_Impact_Memo_Website.pdf.

[7] *Defense Acquisitions: DOD's Use of Other Transactions for Prototype Projects Has Increased* (report no. GAO-20-84, Government Accountability Office, November 2019), https://www.gao.gov/assets/gao-20-84.pdf.

[8] Jim Garamone, "Hicks Discusses Replicator Initiative," *DoD News*, September 7, 2023, https://www.defense.gov/News/News-Stories/Article/article/3518827/hicks-discusses-replicator-initiative/; Joseph Clark, "Defense Innovation Official Says Replicator Initiative Remains on Track," *DoD News*, January 26, 2024, https://www.defense.gov/News/News-Stories/Article/Article/3657609/defense-innovation-official-says-replicator-initiative-remains-on-track/.

[9] Elsa B. Kania, "In Military-Civil Fusion, China Is Learning Lessons from the United States and Starting to Innovate," *Strategy Bridge*, August 27, 2019, https://thestrategybridge.org/the-bridge/2019/8/27/in-military-civil-fusion-china-is-learning-lessons-from-the-united-states-and-starting-to-innovate.

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