U.S. Defense Innovation and Industrial Policy

An Assessment of Where Things Currently Stand

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Abstract: Twice in the twentieth century—during World War II and the Cold War—the United States developed highly impactful industrial policies to support the scale-up of an innovative defense industrial base. The United States now faces a situation in which comprehensive and consequential industrial policy is once again needed to support its national security requirements. The 2022 Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act provides a recent model for the kind of industrial policy that the U.S. government can implement when it adopts a no-holds-barred approach to improving national competitiveness in a critical

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industry. However, the majority of the significant military capabilities used by the U.S. Department of Defense today—and for the foreseeable future—are supplied by a few large defense contractors. These contractors have demonstrated a mastery of large-scale systems integration and manufacturing, an activity that is beyond the scope of smaller firms that excel in the development of innovative technologies. Both the major defense contractors and newer, technology-oriented firms such as Anduril Industries, Leidos, and Palantir Technologies currently lack the available markets or funding that would permit the kind of aggressive approach to improving competitiveness that the United States has applied to semiconductors. Supporting these firms in a more substantial way would require the United States to selectively broaden and deepen its industrial policy efforts and become more organizationally skilled in implementing support of its most critical capability suppliers.

Keywords: defense innovation system, innovation ecosystem, industrial policy

Introduction

During the summer of 2023, two calls to action illustrated the challenges facing the U.S. Department of Defense (DOD) in dealing with technological innovation. The outgoing chairman of the Joint Chiefs of Staff, U.S. Army general Mark A. Milley, expressed the view that "we are witnessing an unprecedented fundamental change in the character of war, and our window of opportunity to ensure that we maintain an enduring competitive advantage is closing."[1] General Milley called for major changes in how the

DOD manages capability development and how new technologies are incorporated into military forces.

At about the same time, entrepreneur and Defense Innovation Board chair Michael R. Bloomberg expressed frustration about the challenges faced by industry in working with the DOD. While supportive of recent changes such as expanded funding for innovative technologies with potential military applications, Bloomberg felt that DOD officials should have much more flexibility and authority to move promising projects forward. He also expressed the view that allowing—and supporting—greater risk-taking and occasional failure in technology adoption would make the DOD a better place to work, attracting in-house talent. Finally, Bloomberg suggested that "the more our military can 'fail fast' in the Pentagon, the more we can succeed on the battlefield."[2]

Both General Milley and Bloomberg recognized the link between innovation and military superiority. While this connection has been demonstrated repeatedly throughout history, for the United States it is World War II and the Cold War that stand out as two moments when the country scaled-up innovative defense industrial bases to win against determined competitors. However, a key observation has been lost in many assessments of where the United States stands today: the crucial role of industrial policy to support innovation and scale-up of the industrial base. In the United States today, only the semiconductor industry is receiving the no-holds-barred approach to industrial policy that reflects the competitive challenges of the moment. Indeed, the 2022 CHIPS and Science Act and associated actions taken by the U.S. executive branch provide a model for industrial policy that causes one to wonder what other domains should be the focus of U.S. industrial policy.[3]

What if the United States were to treat industrial policy support for the U.S. Navy's submarine maintenance and shipbuilding programs or the U.S. Air Force's aircraft production and maintenance programs with this same vigor? What about targeted industrial policy to support all the Services' needs to reconstitute the munitions and missile manufacturing base, collectively laboring—as they are—with supply shortages of critical materials leading to years-long delays?

The reality is that the majority of the significant military capabilities used by the U.S. Service branches today—and for the foreseeable future—are supplied by a few large defense contractors. These contractors have demonstrated a mastery of large-scale systems integration and manufacturing, an activity that is beyond the scope of smaller firms that excel at the development of innovative technologies.

That said, these major defense contractors, as well as newer, technology-oriented firms such as Anduril, Leidos, and Palantir, currently lack the available markets or funding that would permit the kind of aggressive approach to improving competitiveness that the United States has applied to semiconductors. This article examines this issue and suggests that supporting these sectors in a more substantial way would require the United States to selectively broaden and deepen its industrial policy efforts. Importantly, the DOD must become more organizationally skilled at being a knowledgeable client that can effectively support and manage the industrial base. In that context, U.S. president Joseph R. "Joe" Biden Jr. stated in July 2024 during a North Atlantic Treaty Organization (NATO) summit that "we need a new industrial policy in the West. It came as a surprise to some of us how we had fallen behind."[4]

Until quite recently, *industrial policy* has been considered a dirty word in some U.S. policy circles, but now it is most definitely back in vogue.[5] Christian H. M. Ketels defines *industrial policy* as "all economic policies with an industry-specific impact" and remarks that, despite a long history of the United States denying that it uses industrial policy, it "clearly engages in policies that are targeted at specific industries."[6] Linda Weiss suggests that U.S. industrial policy has actually been very transparent and not hidden at all.[7] The U.S. national security apparatus has selectively implemented industrial policies to meet the nation's strategic objectives.[8] The pursuit of these security objectives led to massive support for specific industries during World War II and the Cold War and, in both cases, resulted in a dual-use dividend of U.S. dominance of economically significant industries as a side effect. The U.S. commercial aerospace industry is a good example of this phenomenon.

The roadmap for the rest of this article is as follows. The next section takes the CHIPS and Science Act as a model for what is possible when the U.S. government gets serious about industrial policy in support of a sector with very significant national security implications. The following section examines some of the issues in how defense innovation and manufacturing are currently managed and suggests applying the same no-holds-barred approach to improving competitiveness of the major defense contractor ecosystem and newer technology-oriented firms. The closing section provides some suggested takeaways, the most important of which is that the United States now faces a situation where comprehensive and consequential industrial policy is once again needed to support its national security requirements.

Industrial Policy for Semiconductors

The CHIPS and Science Act is a large-scale implementation of industrial policy that is motivated by national security and may be a model that could be applied to other industries. Traditionally, direct government funding to manufacturers on this scale has been limited to major weapon systems (MWS) such as the Lockheed Martin F-35 Lightning II Joint Strike Fighter. MWS are produced by defense prime contractors led by the “Big Six”: BAE Systems, Boeing, General Dynamics, Lockheed Martin, Northrop Grumman, and RTX. In contrast, semiconductors are an example of dual-use technology (DUT) in which products developed for the commercial market are also vital for defense purposes.

The firms targeted by the CHIPS and Science Act mostly sell DUT to the global commercial market. These include Intel, Micron, and Samsung, as well as the largest chip maker, Taiwan Semiconductor Manufacturing Company. Therefore, firms that will benefit from this legislation are based in both the United States and allied countries such as Taiwan and South Korea. The scope of the promised funding is significant, including $39 billion in subsidies for manufacturing in the United States, 25-percent investment tax credits for manufacturing equipment, and $13.2 billion for semiconductor research and workforce training, for a headline figure of more than $50 billion.[9]

The CHIPS and Science Act is designed to be a major step in improving long-term competitiveness with China in semiconductors. Semiconductors represent the first major DUT ecosystem that the United States and its allies—

Taiwan, Japan, South Korea, and the Netherlands—have endeavored to intervene in for national security reasons.[10] Chips are critical to a wide range of military capabilities, with advanced processors needed to handle the requirements of artificial intelligence (AI) applications.[11] The semiconductor industry is truly global, and it is impossible for any one nation to reshore or even "friendshore" all the elements of production. Robert Huggins and colleagues found that technology development in semiconductors represents an example of "open" innovation characterized by global networks that support the active exchange of information:

> Open innovation can be defined as "the use of purposive inflows and outflows of knowledge to accelerate the internal innovation, and to expand the markets for external use of innovation, respectively." Consequently, a key feature of open innovation is the knowledge-based network that facilitates the interactions necessary to access new knowledge, expertise, technology, and skills. Accordingly, successful innovation is driven by networking that facilitates access to organisational partners possessing complementary knowledge, which is particularly the case in the semiconductor industry.[12]

The extreme globalization that is the nature of the semiconductor industry is the very characteristic that has made it uniquely possible to weaponize the industry by denying China access to parts of it, thereby closing the "Silicon Curtain."[13] This began to happen with the United States and its allies harmonizing export controls for advanced semiconductors and manufacturing equipment. The DOD has also signed an agreement with the U.S. Department of Commerce (DOC) to work together on implementation of the CHIPS and Science Act, with the DOC as the lead agency.[14] Semiconductor manufacturing also offers a good example of the vulnerabilities created by global supply chains, particularly due to the current concentration of key raw materials in Africa and China and of the final stages of production in East Asia. In a study of global supply chains, Laura Christen offers the following commentary on the U.S. CHIPS and Science Act and its counterpart, the European Chips Act:

> Policymakers need to incentivize supply chain diversification through near-/reshoring subsidy programs, invest in strategic stockpiling of critical goods/minerals to increase crisis preparedness and promote international collaboration with like-minded partners including in infrastructure and global manufacturing expansion, stockpiling and crisis monitoring and response. The same applies to the semiconductor industry. In general, the two Chips Acts set the right incentives and are expected to have a positive impact on supply chain resilience.[15]

The experience with industrial policy in semiconductor manufacturing demonstrates that broad measures targeting a nation's economy, infrastructure, and education system are more effective than direct subsidies in isolation. Chris Miller explains that the U.S. government "should focus policy toward the semiconductor industry around four main objectives: promoting technological advances, guaranteeing security of semiconductor supply, retaining control of choke points, and slowing China's technological advances."[16]

A collection of papers on semiconductor policy published in 2023 by the Hoover Institution in partnership with the Asia Society recommends that the United States pursue "comprehensive, market-oriented industrial policy measures as part of a long-term critical-technology global competitiveness agenda."[17] The measures suggested in the papers are likewise wide-ranging, including improvements in immigration policies for skilled workers, better take-home pay for semiconductor industry employees, more investments in K-12 education, and more effective inbound and outbound foreign investment screening and intellectual property protections. The Hoover-sponsored researchers explain:

> In sum, if the United States is to retain and strengthen its global leadership in semiconductors, or even to preserve its most vital economic and national security interests in this sector, it will need to revive the competitiveness of its workforce and business environment. It is not enough to simply constrain China. It is not even enough to innovate in design. The United States must run faster, harder, and with longer-term vision.[18]

While the authors of this article share with many others the view that semiconductors are a critical technology warranting a no-holds-barred approach to improving U.S. competitiveness, there are also military capabilities that need stronger industrial policy support. The next section suggests how some of the industrial policy lessons from semiconductor manufacturing might be transferred to military capabilities, where improving U.S. competitiveness is also vitally important.

The Management of Defense Innovation and Manufacturing

One of the most important features of the U.S. defense industry is that it consists of a complex ecosystem that has emerged over time to meet the requirements of its military stakeholders.[19] Decisions on technology acquisition are made slowly and deliberately, in part to minimize the possibility of error because this quality is favored by the industry's customers. Technical requirements have become highly prescriptive, which has led to an incremental approach to innovation in many systems, again because this suits customers.

The traditional approach to defense acquisition favored by the U.S. military has its supporters and detractors, but there is no doubt that it has led to a system that produces effective military capabilities.[20] However, the current incremental approach to innovation is also partly responsible for creating barriers to entry that lead to monopolistic behavior by the nation's major defense contractors.[21]

During the twenty-first century, advances in technologies relevant to defense have become more widely dispersed both geographically—to include U.S. allies and partners—and by industry sector. The traditional focus on top-down defense innovation driven by the U.S. government now also requires intentional stewardship of bottom-up innovation that results in the adoption by defense entities of DUT that may have been developed for the much larger commercial market. The challenge for the DOD is to ensure that its efforts to adopt both types of innovation are driven by military requirements and also done in an efficient and effective way.[22]

However, Tai Ming Cheung and Thomas G. Mahnken worry that the DOD "is increasingly isolated from large portions of the most innovative and thriving commercial sectors of the economy."[23] They see China, whose national system of innovation operates within a centrally managed economy, as more adept at exploiting civil-military integration than the United States has been. But they also caution that significant differences exist between two the countries' defense innovation ecosystems:

> The U.S. and Chinese techno-security systems are massive, sprawling collections of organizations that cover the most advanced components of their national innovation systems and industrial economies, especially the defense, dual-use, and strategic technology sectors. But these opposing techno-security systems are structured and managed very differently. The Chinese system is primarily state-led and top-down, while the U.S. system is more market-driven and bottom-up. Which of them will ultimately prevail will depend on how capable, robust, and adept they are in meeting the challenge of rapid and disruptive change.[24]

As has been done in the past, the DOD needs to build industrial capacity by effectively leveraging DUT for national security opportunities. John Edwards of Australia's Lowy Institute has emphasized the extent of the challenge that this involves, suggesting that "once dominated by business interests and economic bureaucrats, large areas of industry policy are now shifting into the realm of national security." Edwards adds that "the technology 'war' is inevitably over products mostly commercial in their origin and purpose."[25]

In the United States, there is a widespread perception that the defense industry needs to find ways to bring innovation closer to the warfighter to allow for more rapid adoption and fielding of solutions that address the military's most pressing needs.[26] Again, many DUTs loom large because their readiness for adoption has, in principle, already been proven by success in consumer or commercial markets. The *2022 U.S. National Defense Strategy* explains that "to gain and maintain operational advantage over competitors, the DOD requires an order of magnitude increase in its adoption of commercial technologies. To this end, [the] DOD must act as a fast follower."[27]

In that context, the Big Six and other traditional defense contractors will continue to play a critical role, particularly with respect to systems integration, project management, and manufacturing. Furthermore, as the United States adapts its acquisition system to more easily incorporate commercial technologies, the roadblocks to innovation "are increasingly less about how the U.S. military buys, and more about how it integrates available technologies to support new concepts and tactics."[28]

The increasing importance of technology on the battlefield has pulled Silicon Valley and other technology firms toward the DOD. A turning point occurred in 2016, when software startup Palantir Technologies won a DOD contract, though only after first suing the government to be able to compete with a proposal based on an existing commercial product. Since that time, the emerging "defense tech" sector has grown to hundreds of startup firms supported by billions of dollars of venture investing, with the top 100 defense tech firms drawing a total of $42 billion of venture investments to date.[29]

General Milley suggested the creation of a "Joint Futures organization," inspired by the U.S. Army Futures Command, to better integrate requirements and capability development and more rapidly deliver technology to the warfighter. According to Milley, "a Joint Futures organization would have the potential to align critical force design and development functions, integrate concepts with experimentation, and synchronize users to accelerate modernization and close capability gaps." Notably, the new organization "would *integrate with allies and partners* from the very beginning of force design, looking to enhance not only the Joint Force but also the coalition force, through synchronization and integration of coalition design and development. Allies and partners give the United States an asymmetric advantage over competitors."[30] Allies and partners—both governments and industry—must also be brought into capability development:

> Overall, the United States enjoys a dominant position in the global techno-security order, but needs to do much better to forge collaborative foreign partnerships. China lags by a large margin, although it is making incremental progress in expanding its global techno-security foot-print. The international system will be a pivotal arena for long-term techno-security competition between the United States and China and will likely play an outsized influence in shaping the outcome of this competition.[31]

There are some early signs that the United States is expanding its industrial policies along the above lines, such as through the Australia, United Kingdom, and United States (AUKUS) initiative to produce attack submarines and develop advanced technologies such as quantum computing and hypersonics. The success of AUKUS, when viewed as industrial policy, is critical as an example of "co-innovation" with allies:

> AUKUS is the primary opportunity for the DoD to get openness and collaboration right. It is between longstanding allies who share a

common language, values, and strategic vision, and was formulated in a time of emphasis on allies and partners. Unlike NATO and other established multilateral institutions, the vestiges of Cold War secrecy that shaped their evolution do not have to define AUKUS's future. Properly realized, AUKUS can serve as a 21st century model for co-innovation with allies and partners, and a resounding success as the DoD continues down a new path of innovation cooperation.[32]

In a similar vein, the United States, Canada, and Finland signed the ICE Pact in July 2024. Under this agreement, the three nations will cooperate on the development and production of icebreaking vessels, which are increasingly important given the present militarization of the Arctic region.[33]

The state of shipbuilding in the United States cries out for an effective industrial policy that also leverages the technological capabilities of allies. U.S. shipyards produce five or fewer large commercial vessels a year, which are meant entirely for domestic routes that the law requires be served by ships built in the United States. In contrast, China had 1,794 large vessels under construction, South Korea had 734, and Japan had 587 in 2022. Europe, which retains a sizeable commercial shipbuilding industry, had 319 large vessels under construction.[34] From a national security viewpoint, the lack of U.S. commercial shipbuilding activity is a concern, as U.S. ports oversee about 40 percent of the world's trade by value.[35]

While there are significant differences between large commercial and military ships, the construction delays and backlogs of ships built for the U.S. Navy and Coast Guard reflect a lack of investment by U.S. shipyards and the government, which have not adopted leading commercial practices. For example, South Korea builds combatant vessels such as frigates that have comparable capabilities to U.S. ships and feature some of the same combat systems, and those vessels are built much more quickly and at a much lower cost compared to vessels built in U.S. shipyards.

In 2024, Secretary of the Navy Carlos Del Toro visited South Korean shipyards hoping to attract investment from that country and technology transfer to U.S. industry. The South Korean defense firm Hanwha is in negotiations to purchase Philly Shipyard in Philadelphia, Pennsylvania, and one of Hanwha's shipyards in South Korea has also been authorized to serve as a repair site for U.S. Navy ships.[36]

The development of the defense industry in South Korea has been managed by that country's government to effectively support both domestic requirements and export potential. Bence Nemeth points out that "the South Korean economy has the industrial foundation to maintain a large military and develop indigenous weapons systems cost-effectively."[37]

To remain competitive in the development and manufacturing of defense technology, the United States should further expand its industrial policy beyond semiconductors to include additional critical sectors. Such efforts in additional industries must go beyond simply denying technology to China and other adversaries.[38] In that context, the DOD has taken steps to reinforce the industrial base and promote apprenticeships and education in fields related to shipbuilding.[39]

The DOD will need to expand its efforts to more explicitly leverage DUT while continuing to effectively manage the development, manufacturing, and fielding of MWS. However, a broader and coordinated approach among federal agencies is also needed to maintain U.S. defense-related technological leadership. For example, the DOC could play a role in "much deeper, competitive analysis on key industries and strategies for how all federal policies, programs, and practices can be aligned to support, rather than harm, U.S. competitiveness in key sectors."[40] As Seth G. Jones and Alexander Palmer suggest, "The U.S. defense industrial base—led by a robust and strengthened commercial industry—needs to be a key pillar of broader U.S. industrial policy strategy to compete with China economically, technologically, and militarily."[41]

While the DOD is capable of funding large numbers of technology development projects, by necessity few of even the most promising innovations will transition to production. This is because funding is not available for the large-scale fielding of every innovative product that receives initial research and development support, leading to the "valley of death" problem. A broader and more effective industrial policy will need to reconcile this issue in a way that promotes private investment and continuing technological leadership while recognizing financial constraints.[42]

Therefore, the DOD needs a robust decision-making process at every stage of the innovation process that downselects the prospectively most promising technologies, including both DUT and MWS. Ray Khan proposes an approach to dealing with this challenge:

> During the early stages of a technology development project, the Department of Defense will likely not be able to accurately and/or methodically figure out a project's value (bang for the buck). More importantly, the military needs to let its technologists mature the projects for two to five years with a "fail fast" mindset, while "desired" technology projects may be allowed a longer maturation schedule.

> Once technology development projects start to prove their legitimacy, the Defense Department needs its innovators to start doing the hard work of research and analysis to assess the projects implementability and sustainability. This assessment will determine a project's value (bang for the buck) and allow for the worthiest projects to move forward towards successful fielding.[43]

Many MWS take decades to develop and may have long service lives as well. However, DUT typically has a much shorter life, which makes integration into MWS challenging. Despite this reality, there have been some successes, such as Boeing B-52 Stratofortress strategic bombers delivered in 1962 currently being refitted with Rolls-Royce engines developed for business jets. These venerable aircraft will remain in service for decades to come, partly because of the insertion of commercial technology. The bombers are also being modified to launch hypersonic missiles, another demonstration of their adaptability.[44]

The DOD does not yet have a way to systematically conduct integrated concept development and "bottom up" commercial technology adoption, let alone include allies from the early stages. While the DOD has created dozens of innovation organizations such as the Defense Innovation Unit (DIU), the Office of Strategic Capital (OSC) and NavalX, to date these organizations have had a limited ability to facilitate adoption through the procurement and fielding of new products.[45]

The DOD's measures to date have been described by a Defense Innovation Board task force as a "series of top-down olive branches" to the growing U.S. technology ecosystem. However, the task force also recognized that these measures were "a good sign our military's leaders understand [that] a divided technology ecosystem will ultimately undermine U.S. national security competitiveness, especially against centralized military-civil fusion in China."[46] Increased integration of the DUT and MWS ecosystems therefore lies at the heart of the requirement for a broadly based U.S. industrial policy.

During the past several years, a wide range of experts have called for the DOD to end "innovation tourism" and undertake a large-scale reorganization of requirements definition, capability development, acquisition, and the fielding of new technology.[47] The more flexible forms of relationships with the private sector pioneered by the DIU and similar DOD organizations have suffered from a lack of resources and institutional support.[48] A review of the experiences of defense innovation organizations or "intermediaries" in the United Kingdom found a need for well-defined responsibilities, feedback mechanisms, and interorganizational communications, concluding that there is an "intermediation paradox: while failures in the institutional architecture justify the creation of intermediaries, the very same failures limit their effectiveness."[49] A key leadership challenge is the extent to which innovative practices and technologies become embedded and routine within the DOD:

> The acquisition ecosystem is still far detached from and, in many cases, cannot collaborate with the warfighter to meet their needs—resulting in disjointed efforts around innovation, scale, and importantly, speed. The concept of innovation is often bolted on versus baked into programs and without metrics for people innovation readiness levels, to supplement technology readiness levels, efforts to increase speed and scale are akin to flying blind to an unknown destination.[50]

The general consensus of the diverse studies on DOD innovation is that the DOD requires a major organizational response that will align specifically with both the DUT and MWS ecosystems, while coordinating with other U.S. government agencies as well as allies and partners. At the current time, the DOD is simply not designed for these outcomes:

> Successful innovation will be driven by organizational structures that encourage: interactions beyond boundaries and stovepipes, continuous learning, creativity, finding new connections, and facilitation of interactions with relevant users. At the same time, organizationally, [the] DOD is not optimized except in specific urgent circumstances to: make fast, agile changes, with a sense of urgency, adopt innovative approaches, measure the success of innovation, or support processes that are different from the day-to-day operations.[51]

Domestically, the DOD also needs to expand its efforts to become an attractive employer. This may include seeking legislative and regulatory authority to bring more flexibility to personnel policy, such as by ending the post-Vietnam War "up or out" system for military personnel and removing civilian personnel from the rigid General Schedule system created by the Classification Act of 1949.[52] Another possibility is the expansion of existing programs involving exchanges with industry. There will be a significant requirement for government personnel who understand industry and technology and can function as knowledgeable clients for both MWS and DUT.[53] Jared Mondschein and colleagues at the Rand Corporation suggest that with respect to microelectronics, there is a clear need "for coordinated, well-defined SCRM [supply chain risk management] practices at the strategic, tactical, and operational levels."[54] The Defense Innovation Board had the following acerbic comment on DOD personnel management practices:

> Rather than establishing professional innovation officers, empowering and assigning novel career pathways, or adapting to the expanding mission-driven private sector opportunities with which the Department vies for talent—the Department misperceives itself as being the premier avenue for "public service" and maintains an archaic, 20-year career track for servicemembers and civilians alike; this no longer a competitive approach to talent management in the 21st century.[55]

Closing Thoughts

This review of U.S. defense innovation and industrial policy closes with the highlighting of four key issues that continually emerge from the voluminous literature on this topic that need addressing and resolving.

First, during the Cold War, the United States and its allies demonstrated significant government support for corporate research, development, and innovation that ultimately defeated the Soviet Union. Implementation of "military-civil fusion" did not originate in China but rather in the governments of Western countries. Today, however, it is the U.S. government that needs to once again broaden its efforts at military-civil fusion. This will involve policy changes and funding devoted to industries other than semiconductors, such as shipbuilding. The question is how the United States can become more skilled in the implementation of industrial policy, thereby bringing the benefits of capitalism and democracy to its competition with China. Doing so may also require the United States to moderate some of its tendencies toward nationalism or technological isolationism that can shut out even its closest allies.

Second, major weapon systems require long development cycles, careful testing, and well-considered fielding and sustainment. Large defense contractors have demonstrated a mastery of large-scale systems integration and manufacturing, an activity that is beyond the scope of smaller firms that excel at the development of innovative technologies, often for both commercial and military use. There is no question that the major defense contractors are an essential resource for the United States and that the DOD needs to be a knowledgeable client for the full scope of technology development and integration, regardless of where it originates. In sum, appropriating more commercial technology for military use is an "and" rather than an "either-or" issue. A key issue is to what extent the DOD can make the "primes," or large defense contractors, a major resource in leveraging more commercial technologies.

Third, given the difficulty of wide-ranging reforms to acquisition policies and funding mechanisms, the tendency to engage in "innovation tourism" is understandable. Organizations such as the DIU have demonstrated that they can get innovative technologies into the hands of warfighters. But the existence of innovation organizations is an indicator that large-scale acquisition organizations, such as the Program Executive Offices (PEOs) of the U.S. military departments, are not succeeding at effective and timely commercial technology adoption. The question is to what extent PEOs will be able to absorb the capabilities of the DIU and its brethren.

Finally, Americans are willing to serve their country in uniform and in the civil service, but they expect the government to be a good employer.

Current policies, such as those for managing officer careers or recruiting and retaining civilian employees, need an overhaul. The DOD has a pattern of attempting marginal reforms in the personnel area that affect relatively few people or have a negligeable impact altogether. There are positive signs of change, such as the U.S. Marine Corps' reforms of military careers that are being implemented alongside *Force Design 2030*, or the recent creation of the Defense Civilian Training Corps for university students.[56] The government needs to be a knowledgeable client for the design, development, acquisition, fielding, and use of technology. Accordingly, the key issue for DOD personnel management is how bolder reforms might be designed for more substantial and long-term benefits for the nation.

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[1] Gen Mark A. Milley, USA, "Strategic Inflection Point: The Most Historically Significant and Fundamental Change in the Character of War Is Happening Now—While the Future Is Clouded in Mist and Uncertainty," *Joint Force Quarterly* 110, 3d qtr. (July 2023): 6–15.
[2] Michael R. Bloomberg, "To Innovate, DoD Must Be Allowed to Move Faster," *Defense News*, 24 July 2023.
[3] CHIPS and Science Act, Pub. L. No. 117–167, 136 Stat. 1366 (2022).
[4] Stephen Grey, John Shiffman, and Allison Martell, "Years of Miscalculations by U.S., NATO Led to Dire Shell Shortage in Ukraine," Reuters, 19 July 2024.
[5] Greg Ip, " 'Industrial Policy' Is Back: The West Dusts off Old Idea to Counter China: An Approach Long Criticized as Inefficient Is Being Adopted by the U.S. to Fund Sectors Such as Semiconductors," *Wall Street Journal*, 29 July 2021.
[6] Christian H. M. Ketels, "Industrial Policy in the United States," *Journal of Industry, Competition and Trade* 7, no. 3 (2007): 147–67, https://doi.org/10.1007/s10842-007-0017-7.
[7] Linda Weiss, "Re-emergence of Great Power Conflict and U.S. Economic Statecraft," *World Trade Review* 20, no. 2 (2021): 152–68, https://doi.org/10.1017/S1474745620000567.
[8] Gregory Hooks, "The Rise of the Pentagon and U.S. State Building: The Defense Program as Industrial Policy," *American Journal of Sociology* 96, no. 2 (September 1990): 358–404.
[9] "Fact Sheet: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China," White House Briefing Room, 9 August 2022.
[10] Weiss, "Re-emergence of Great Power Conflict and U.S. Economic Statecraft"; and Chris Miller, *Chip War: The Fight for the World's Most Critical Technology* (New York: Scribner, 2022), 49.
[11] John Edwards, "Chips, Subsidies, Security, and Great Power Competition," Lowy Institute, 28 May 2023.

[12] Robert Huggins et al., "Competition, Open Innovation, and Growth Challenges in the Semiconductor Industry: The Case of Europe's Clusters," *Science and Public Policy* 50, no. 3 (June 2023): 531–47, https://doi.org/10.1093/scipol/scad005.
[13] Henry Farrell and Abraham Newman, "How the U.S. Stumbled into Using Chips as a Weapon against China," *Wall Street Journal*, 9 September 2023.
[14] "Department of Commerce and Department of Defense Sign Memorandum of Agreement to Strengthen U.S. Defense Industrial Base," Department of Defense, 26 July 2023; and Matthew Eitel, "Export Controls—The Keys to Forging a Transatlantic Tech Shield," Center for European Policy Analysis, 20 July 2023.
[15] Laura Christen, *The Global Supply Chain Challenge: An Analysis of Global Supply Chain Vulnerabilities and How to Resolve Them Using the Example of the Semiconductor Industry* (New York: American Council on Germany, 2022).
[16] Chris Miller, "Rewire: Semiconductors and U.S. Industrial Policy," Center for a New American Security, 19 September 2022.
[17] Larry Diamond, James O. Ellis Jr., and Orville Schell, eds., *Silicon Triangle: The United States, Taiwan, China, and Global Semiconductor Security* (Stanford, CA: Hoover Institution Press, 2023), x.
[18] Diamond, Ellis, and Schell, *Silicon Triangle*, xiii.
[19] Jan Jørgensen and Henry Mintzberg, "Emergent Strategy for Public Policy," *Canadian Public Administration* 30, no. 2 (June 1987): 214–29, https://doi.org/10.1111/j.1754-7121.1987.tb00079.x.
[20] Eugene Gholz and Harvey M. Sapolsky, "The Defense Innovation Machine: Why the U.S. Will Remain on the Cutting Edge," *Journal of Strategic Studies* 44, no. 6 (2021): 854–72, https://doi.org/10.1080/01402390.2021.1917392.
[21] Renaud Bellais, "Market Structures, Competition and Innovation: Grounds for an Alternative Defence Industrial Policy," *Defence and Peace Economics* 35, no. 4 (2023): 448–63, https://doi.org/10.1080/10242694.2023.2182869; and Renaud Bellais, "Sécurité d'approvisionnement et constitution de stocks stratégiques, un enjeu géostratégique et économique" [Security of Supply and Creation of Strategic Inventories: A Geostrategic and Economic challenge], *Défense et sécurité internationale* [*Defense and International Security*] 170 (March–April 2024): 22–25.
[22] *Innovation de défense, d es instruments à renforcer* [*Defense Innovation: The Need to Strengthen Tools*] (Paris: Institut Montaigne, 2023); and Kurt Scherer and Faith Ozmen, "Maintaining the U.S. Defense Sector's Competitive Edge," *War on the Rocks*, 18 July 2023.
[23] Tai Ming Cheung and Thomas G. Mahnken, *The Decisive Decade: United States–China competition in Defense Innovation and Defense Industrial Policy in and beyond the 2020s* (Washington, DC: Center for Strategic and Budgetary Assessments, 2023), 7.
[24] Cheung and Mahnken, *The Decisive Decade*, 1–2.
[25] Edwards, "Chips, Subsidies, Security, and Great Power Competition."
[26] "Can Tech Reshape the Pentagon?," *Economist*, 8 August 2022 ; and "An Innovation Strategy for the Decisive Decade," National Defense Science and Technology Strategy Review Task Force, Defense Innovation Board, 17 July 2023.
[27] *2022 National Defense Strategy of the United States of America* (Washington, DC: Department of Defense, 2022); and David Vergun, "DOD Modernization Relies on Rapidly Leveraging Commercial Technology," *DOD News*, 25 January 2023.
[28] Bryan Clark, "Adm. Franchetti, Biden's Pick for CNO, Should Focus on the Short Game," *Navy Times*, 21 August 2023.

[29] Heather Somerville, "Investors Are Betting on Defense Startups. The Pentagon Isn't," *Wall Street Journal*, 25 January 2024; and "SVDG Leads Industry Letter to Congress in Support of DIU," Silicon Valley Defense Group, 24 October 2023.
[30] Milley, "Strategic Inflection Point," emphasis in original.
[31] Cheung and Mahnken, *The Decisive Decade*, 33.
[32] *Optimizing Innovation Cooperation with Allies and Partners* (Washington, DC: Defense Innovation Board, 2024), 7–8.
[33] Andrea McFeely et al., *Connecting the AUKUS Innovation Ecosystem* (Bedford, MA: MITRE, 2024); "Biden-Harris Administration Announces New Polar Partnership 'ICE Pact' alongside Finland and Canada," White House Briefing Room, 11 July 2024; and LtCol Kristen Heiserman, USAF, "Snowblind: Investing in Logistical Infrastructure in the Arctic to Support the Indo-Pacific and the North Atlantic Treaty Organization," *Journal of Indo-Pacific Affairs* (July–August 2024): 34–52.
[34] John Frittelli, *U.S. Commercial Shipbuilding in a Global Context* (Washington, DC: Congressional Research Service, 2023).
[35] *Transportation Statistics Annual Report 2023* (Washington, DC: Department of Transportation, 2023), https://doi.org/10.21949/1529944.
[36] *Navy Shipbuilding: Increased Use of Leading Design Practices Could Improve Timeliness of Deliveries* (Washington, DC: Government Accountability Office, 2024); Laura Heckmann, "Korean Defense Company Focused on Localized Facilities for U.S. Expansion," *National Defense*, 3 June 2024; "Hanwha Agrees to Pay $100M to Acquire Philly Shipyard," Maritime Executive, 20 June 2024; and "Hanwha Ocean Certified to Compete for U.S. Navy Maintenance Work," Maritime Executive, 22 July 2024.
[37] Bence Nemeth, "South Korean Military Power: Lessons Europe Can Learn from Seoul on Spending Defence Budgets Efficiently," *RUSI Journal* 169, no. 1–2 (2024): 92–101, https://doi.org/10.1080/03071847.2024.2355136.
[38] Robert D. Atkinson, "Speed up America, Slow down China, or Both?: The Key Strategic Question for the 21st Century," Information Technology and Innovation Foundation, 28 August 2023.
[39] *National Defense Industrial Strategy: June 2024 Interim Implementation Report* (Washington, DC: Department of Defense, 2024).
[40] Robert D. Atkinson et al., "A Techno-Economic Agenda for the Next Administration," Information Technology and Innovation Foundation, 10 June 2024.
[41] Seth G. Jones and Alexander Palmer, *Rebuilding the Arsenal of Democracy: The U.S. and Chinese Defense Industrial Bases in an Era of Great Power Competition* (Washington, DC: Center for Strategic and International Studies; London: Rowman and Littlefield, 2024), 43.
[42] Ray Khan, "Charting the Military's Path across the Technology Valley of Death Using Bar Napkin Math," *War on the Rocks*, 11 July 2023.
[43] Khan, "Charting the Military's Path across the Technology Valley of Death Using Bar Napkin Math,"
[44] "Boeing B-52 Stratofortress," in *Janes All the World's Aircraft in Service* (Croydon, UK: Janes, 2022).
[45] Brodi Kotila et al., *Fostering Innovation in Military Technology: Strengthening DOD's Commercial Technology Pipeline* (Santa Monica, CA: Rand, 2023); and Raj M. Shah and Christopher Kirchhoff, *Unit X: How the Pentagon and Silicon Valley Are Transforming the Future of War* (New York: Scribner, 2024), 237–46.

[46] "Terraforming the Valley of Death: Making the Defense Market Navigable for Startups," Strategic Investment Capital Task Force, Defense Innovation Board, July 2023.
[47] Melissa Flagg and Jack Corrigan, *Ending Innovation Tourism: Rethinking the U.S. Military's Approach to Emerging Technology Adoption* (Washington, DC: Center for Security and Emerging Technologies, 2021).
[48] Bharat Rao, Adam J. Harrison, and Bala Mulloth, *Defense Technological Innovation: Issues and Challenges in an Era of Converging Technologies*, New Horizons in Innovation Management Series (Cheltenham, UK: Edward Elgar Publishing, 2020), 17–38, https://doi.org/10.4337/9781789902105.
[49] Kostas Selviaridis, Alan Hughes, and Martin Spring, "Facilitating Public Procurement of Innovation in the UK Defence and Health Sectors: Innovation Intermediaries as Institutional Entrepreneurs," *Research Policy* 52, no. 2 (March 2023): 104673, https://doi.org/10.1016/j.respol.2022.104673.
[50] *Aligning Incentives to Drive Faster Tech Adoption* (Washington, DC: Defense Innovation Board, 2024), 4.
[51] Jennifer M. Taylor, "Framework for Organizational Needs of Innovation in the Department of Defense," in *Proceedings of the Nineteenth Annual Acquisition Research Symposium* (Monterey, CA: Naval Postgraduate School, 2022), 14.
[52] Douglas A. Brook and Cynthia L. King, "Enactment and Implementation of the National Security Personnel System: Policy Made and Policy Unmade," *Public Administration Review* 71, no. 6 (2011): 900–8, https://doi.org/10.1111/j.1540-6210.2011.02438.x.
[53] Miller, "Rewire."
[54] Jared Mondschein, Jonathan W. Welburn, and Daniel Gonzales, *Securing the Microelectronics Supply Chain: Four Policy Issues for the U.S. Department of Defense to Consider* (Santa Monica, CA: Rand, 2022), 7.
[55] *Aligning Incentives to Drive Faster Tech Adoption*, 4.
[56] See *Force Design 2030* (Washington, DC: Headquarters Marine Corps, 2020); and "Defense Civilian Training Corps," DCTC.mil.