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COMMERCIAL DUAL-USE TECHNOLOGIES IN DEFENSE ACQUISITION REFORM

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EXECUTIVE SUMMARY

Over the last twenty years or so, the United States' defense acquisition system has grown too risk-averse, too slow and too costly. As a result, our military technological advantage has atrophied to the detriment of the development and fielding of new, innovative warfighting capabilities.

Instead, today, the most promising advances in technological innovation come from the commercial sector, where research and development (R&D) now dwarfs U.S. government investments—so much so that even to combine the R&D spending of the Department of Defense's (DoD) top five prime contractors would not rank them among the top 20 industrial spenders worldwide.¹

1. "Military Acquisitions: DoD is Taking Steps to Address Challenges Faced by Certain Companies," Report to the Committee on Armed Services, U.S. Senate GAO-17-644, July 2017, p. 6 (hereafter GAO Report 17-644). <http://www.gao.gov/assets/690/686012.pdf>.

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Against this backdrop, more and more of the technologies that the military will need to remain dominant are being developed by commercial firms, in particular by commercial startups that are pioneering in the areas of satellite imaging, robotics and autonomous mobility, information security and encryption technology, AI-enabled sensor fusion platforms, machine vision and multi-spectrum sensors, mobile computing, flexible electronics, hypersonic munitions, directed energy, electronic warfare, nanotechnology and lightweight protective materials. However, many of these companies have traditionally avoided doing business with the DoD and thus if the United States does not find a way to foster better collaboration with these firms, it will continue to fall behind.

Recognizing this problem, Congress has enacted significant reforms over the past few years that have sought to close the defense technological gap between the United States and its adversaries. For example, it has reorganized the DoD's acquisition directorate to make it more effective at ensuring continued access to commercial innovation. It has also created alternative pathways to improve and accelerate the DoD's acquisition and adaptation of new commercial technologies for military use. It has also promoted fairness and consistency in commercial-item and price-reasonableness determinations that are akin to what these companies encounter in the commercial marketplace.

Meanwhile, over the same period, the DoD has established defense technology outposts in Silicon Valley and other technology hubs around the country that have helped to identify and support commercial technologies that can be applied for military use and to help those developers do business with the DoD. As a result, today, the opportunities for small, commercial, non-traditional suppliers of new, technologically innovative products and services to sell to the DoD are as promising as ever. And, in part, this has been made possible by a regulatory environment that has become favorable to doing business with the Pentagon.

Accordingly, many venture capital (VC) funds have taken notice of investment opportunities that have arisen from the DoD's engagement with these suppliers and have injected billions of dollars of outside investment capital to seed and support these startups. However, in order for the DoD to have continued access to these emerging technologies and to leverage them in connection with its procurement priorities, it will effectively have to manage the ecosystem within which all of these stakeholders operate.

In order to do this, the DoD should: 1) reorganize the acquisition directorate and implement the recent legislative reforms, as intended by Congress; 2) place the right acquisition professionals in the right management positions at the DoD and give them the necessary authority and resources to discharge their newly-created responsibilities; 3) drive this new innovation paradigm through the military departments so that they can employ rapid acquisition modalities to help the warfighter to obtain what they need in a timely and cost-effective manner; and 4) use performance metrics to track how successfully the DoD procures and employs innovative commercial technologies from non-traditional suppliers.

Put simply, the status quo is unaffordable and unsustainable, and thus the DoD (and Congress) must maintain and promote a new defense technological innovation ecosystem that allows all relevant stakeholders—particularly the DoD—to extract intended benefits. While it may be true that such a strategy is not a panacea for all that ails the defense procurement process, it would do much to correct a problem that the DoD and Congress have struggled with for decades.

INTRODUCTION

In the area of defense technology, the Department of Defense's (DoD) development of new military technologies has been impressive. However, as exciting as strides towards, say, an electromagnetic rail-gun or directed energy capability are, something considerably more important is happening. Namely, there is increasing consensus among the DoD, Congress and industry that in order for the nation to maintain superiority over its adversaries, the DoD must embrace emerging commercial technologies that are adaptable for military use, or new “dual-use” commercial-military technologies.

Such an understanding has already been achieved by other nations. For example, in July 2017, China announced an ambitious, multi-dimensional policy approach to artificial intelligence (AI) that was intended to help it leapfrog the United States—and ultimately lead the world—in that technology, specifically by ensuring that China leverages com-

mercial advances in AI for national defense.² This approach will include mergers and acquisitions, as well as venture capital (VC) investments in China and overseas, including in the United States. Such an announcement is in keeping with China's strategy since at least 2012, which has included investing significantly and strategically in U.S. start-ups that are developing emerging technologies with potential military applications.³

Meanwhile, this past summer, Secretary of Defense James Mattis conveyed strong support for the mission of the U.S. Defense Innovation Unit Experimental (DIUx), a fairly new division within the DoD that is responsible for helping “bridge the gap” between the DoD and U.S. technology hubs.⁴ Also, in connection with next year's budget request, the White House Office of Management and Budget (OMB) has asked the DoD to consider investing in R&D programs that could potentially be leveraged for non-military use: “The administration recognizes the contributions of military R&D to the development of tremendously useful civil applications. Accordingly, we encourage programs with dual-use potential to be leveraged for federal non-military advancements.”⁵ These are welcome preliminary developments.

THE IMPERATIVE FOR CHANGE

For decades, as the DoD has developed capabilities that have enabled it to become the most powerful fighting force in history, it has greatly contributed to the development of innovative technologies subject to civilian use. Perhaps most famously, the Defense Advanced Research Projects Agency's (DARPA) work on computer networking led us to the Internet and such innovations continue in earnest in areas such as hypersonics, unmanned aerial vehicles and robotics.

2. Elsa Kania, “The Dual-Use Dilemma in China's New AI Plan: Leveraging Foreign Innovation Resources and Military-Civil Fusion,” *Lawfare*, July 28, 2017, <https://www.lawfareblog.com/dual-use-dilemma-chinas-new-ai-plan-leveraging-foreign-innovation-resources-and-military-civil>.

3. Recent examples include investments made in 2016 by Chinese fund Haiyin Capital in the Boston-based AI start-up Nurala and Mojave, CA-based commercial space-travel manufacturer XCOR Aerospace, which had been doing business with the U.S. Air Force and NASA, respectively. It also includes an acquisition by Chinese firm Baidu of xPerception, which specializes in computer vision. See, e.g., Paul Mozur and Jane Perlez, “China Bets on Sensitive U.S. Start-Ups, Worrying the Pentagon,” *The New York Times*, March 22, 2017, <https://www.nytimes.com/2017/03/22/technology/china-defense-start-ups.html>. Notably, NATO's Communication and Information (NCI) Agency plans to invest three billion EUR through 2019 to strengthen cyber, air and missile defense. See, e.g., NATO Communications and Information Agency, “NATO announces 3 billion EUR investment in defence technology,” Press Release, July 26, 2016, https://www.ncia.nato.int/NewsRoom/Pages/160726_Announcement_3billion_investments.aspx.

4. Tom Simonite, “Secretary of Defense James Mattis Envis Silicon Valley's AI Ascent,” *Wired*, August 11, 2017, <https://www.wired.com/7story/james-mattis-artificial-intelligence-diu-x>.

5. Mick Mulvaney and Michael Kratsios, “FY 2019 Administration Research and Development Budget Priorities,” *Memorandum for the Heads of Executive Departments and Agencies M-17-30*, August 17, 2017, p. 1, <https://www.whitehouse.gov/sites/whitehouse.gov/files/ostp/fy2019-administration-research-development-budget-priorities.pdf>.

But, over the past fifteen years, the ways the DoD has deployed resources for R&D have also seen spectacular failures. For example, in 1987, the DoD accounted for about 40% of *all* research and development spending in the United States. However, by 1990, the U.S. Government Accountability Office (GAO) found that the DoD's methods for the procurement and development of major systems had subjected taxpayer dollars to an excessive risk of waste, fraud or abuse. Indeed, according to research conducted by the author, since 2001, the DoD has wasted about \$47 billion on just ten failed major acquisition programs—without delivering any meaningful combat capability.⁶

According to a seminal report, between 1995 and 2009, the Army alone spent about 40% of its R&D-related resources—which totaled at least \$32 billion—on 22 programs that were ultimately cancelled.⁷ This amounts to at least \$1 billion every year since 1995 spent on failed programs.⁸ By 2004, that number had increased to between \$3.3 billion and \$3.8 billion per year on cancelled Army programs—an average of 35-45% of the Army's total annual budget for R&D.⁹

To detail the reasons for this exceeds the scope of this paper, however, a couple of observations are worth making. First, for years, the DoD misallocated massive amounts of R&D funding in major defense procurement programs that were fatally infected by excessive concurrency.¹⁰ Consequently, huge cost overruns occurred, which were largely borne by taxpayers. Moreover, in many cases, the “transformational” capability promised by these programs was accompanied by a degree of development risk that exceeded the DoD's ability to identify, price and responsibly manage it. Put simply, when it came to identifying and mitigating technological-maturity risk, systems-level development risk and integration risk on these massive programs, the DoD had an understanding insufficient to justify its investment decisions. This resulted in the outcome described above, and by 2013, the DoD's R&D expenditures dropped to only about 20% of all such spending in the United States.¹¹

Meanwhile, technological innovation in the United States exploded in the commercial sector, particularly among companies that have not traditionally contracted with the DoD, including those developing artificial intelligence (AI) capability, robotics and autonomous mobility, machine vision and multi-spectrum sensors, mobile computing, flexible electronics, satellite imaging, information security and encryption technology, hypersonic munitions, nanotechnology and lightweight protective materials.

With the support of outside investors, particularly in the VC community, the AI sector—which has developed technologies that are especially promising for military applications—has been particularly robust. In 2017 alone, there have been 112 AI funding events, which have helped these startups raise \$2.7 billion¹² and 25 exit events.¹³ Notably, to date, all technological categories in the AI sector¹⁴ have accounted for about 35% of all VC funding. Additionally, in 2016, seed, crowd, series A, B, C, D and VC funding of robotics-related startups funded 128 companies for a total of \$1.95 billion. This is 50% more than in 2015, which was also an excellent year with over \$1.32 billion.¹⁵

However, while the commercial marketplace has exploded with enormously impressive technological innovations, the DoD has been beleaguered by the high military operational tempo caused by the wars in Iraq and Afghanistan and by chronic budget instability. For these reasons, during this period, the most innovative commercial technology companies stayed away from doing business with it. For example, according to the General Accountability Office (GAO), of the \$216 billion in sales that Apple earned in 2016, only \$70,000 came directly from DoD contracts.¹⁶ Similarly, Amazon earned only about \$275,000 from doing business with the DoD directly, despite raking in \$136 billion in total sales.¹⁷ Google and Facebook earned no revenue through direct sales to the military.¹⁸

Recently, the GAO looked into the reasons for this disinterest in partnering with the DoD. In a recent report, several commercial companies responded that the way the DoD

6. Original research by the author. Data drawn from *inter alia* the Department of Defense's "Selected Acquisition Reports (SARs) relating to cited programs and analysis of cited programs. See also, "Defense Acquisitions: Assessments of Selected Weapon Programs," Government Accountability Office, 2017. <https://www.gao.gov/products/GAO-17-333SP>.

7. *Army Strong: Equipped, Trained and Ready, Final Report of the 2010 Army Acquisition Review*, United States Army, January 2011, p. 163. http://www.rdecom.army.mil/EDCG_Telecoms/Final_Report_Army_Acq_Review.pdf.

8. *Ibid.*

9. *Ibid.*

10. Excessive concurrency exists when there is too much overlap between development and production activities through the acquisition lifecycle of programs. It exposes them to a high-risk of engineering discoveries, costly redesign and the need for retrofits late in production.

11. GAO Report 17-644, p. 6. <http://www.gao.gov/assets/690/686012.pdf>.

12. "Artificial Intelligence Market Overview and Innovation Quadrant - Q1 2017," Venture Scanner, April 7, 2017. <https://www.venturescanner.com/blog/2017/artificial-intelligence-market-overview-and-innovation-quadrant-q1-2017>.

13. *Ibid.*

14. These include everything from smart robots, natural language processing, recommendation engines and video speech recognition to machine-learning applications that use sophisticated algorithms to detect bank fraud, for example.

15. Frank Tobe, "2016 best year ever for funding robotics startup companies," *The Robot Report*, January 2, 2017. <https://www.therobotreport.com/2016-best-year-ever-for-funding-robotics-startup-companies>.

16. GAO Report 17-644, p. 8.

17. "AMZN Company Financials," Nasdaq, Dec. 18, 2017. <http://www.nasdaq.com/symbol/amzn/financials?query=income-statement>.

18. GAO Report 17-644, p. 8.

implements laws that provide transparency and fairness, along with regulations that promote specific socio-economic goals have resulted in an acquisition environment that is overly complicated, too costly and too slow. Such challenges are exacerbated by a workforce that does not understand how private industry does business to the degree necessary to incentivize desired performance.¹⁹ So, rather than to try to do business with the DoD, many non-traditional companies chose instead to direct their resources to the commercial marketplace, where the cost to compete is lower and contract-award decisions are faster.²⁰

In view of this, any efforts to reform the DoD's military procurement capability should include a relaxation of the barriers that have impeded its full access to the commercial marketplace, particularly to those startups that have been developing emerging "dual-use" technologies. Further, when procuring combat capability, the DoD should "export" development risk wherever possible to innovators who are already incentivized to take on their own risk—at little or no cost to the government.

One creative and effective way to do this involves leveraging efforts by investors who are already incentivized to scout, conduct due diligence on and financially invest in those companies. In other words, attempts by the DoD to reform how it procures combat capability should include a change in its approach to technological innovation. While not a panacea, it is an important part of the solution. As Mark Siegel, managing partner at Menlo Ventures, has argued: "The days of thinking that all the tech innovation that the government needs is going to come out of federal agencies themselves or in federal labs are over."²¹ Accordingly, attempts to reform the defense procurement process must consider and embrace this new reality.

THE EMERGENCE OF A NEW DEFENSE R&D PARADIGM

Fortunately, over the last few years, the DoD, Congress and industry have reached the following broad agreements: 1) that our military technological advantage has eroded relative to that of our adversaries as they modernize their military capabilities; 2) that a new R&D paradigm exists today wherein commercial R&D now dwarfs DoD investment and thus the most promising advances in technological innova-

tion come from the commercial sector;²² 3) that the combat capability the U.S. military needs to stay dominant in the air, land, sea and cyberspace will have to come from technologies that are being developed by these commercial firms; 4) that too many of these companies have heretofore avoided doing business with the DoD; and 5) that they have done so largely because, as Senate Armed Services Committee Chairman John McCain has rightly observed, the defense acquisition system "has grown too risk-averse, takes too long, and costs too much" to innovate, develop and field new capabilities.²³

However, today, through the alignment of three spheres of interrelated activity by the DoD, Congress and the outside investment community, we appear to be seeing evidence of such an adjustment. First, under the leadership of then-Secretary of Defense Ash Carter, the Defense Innovation Unit Experimental (DIUx) was originally established in 2016 to help the DoD build key relationships in the nation's technology hubs and to help them navigate the DoD's bureaucratic and regulatory challenges. Since then, the DIUx has been interacting with these companies in ways that engender confidence among the outside investment community and today, with a presence in D.C., Silicon Valley, Boston and Austin, DIUx identifies, helps sustain and advances emerging commercial technologies that the DoD finds promising. It then helps to facilitate deals between those innovators and the relevant DoD contacts.²⁴

Acquisition improvements

Since its inception, the DIUx has used its flexible contracting authority to enter into agreements directly with non-traditional companies for prototyping projects and has awarded roughly \$71 million in contracts for 37 pilot projects in the key areas of autonomy, artificial intelligence, human systems, information technology and space.²⁵ Most recently, the DIUx announced that it will work with the Air Force in Qatar to leverage applications developed by small, innovative non-

19. Ibid.

20. Ibid., p. 9.

21. Heather Sommerville, "Defense Department's tech investing signals Silicon Valley's importance in cyberwarfare," *San Jose Mercury News*, May 21, 2015. <https://phys.org/news/2015-05-defense-department-tech-investing-silicon.html>.

22. See GAO Report 17-644, p. 10; and Michael J. Sullivan, "Defense Acquisition: Addressing Incentives is Key to Further Reform Efforts," *Testimony Before the Committee on Armed Services*, U.S. Senate, GAO-14-563T, April 30, 2014, p. 1. <https://www.gao.gov/assets/670/662837.pdf>. By 2013, the DoD accounted for less than 20% of the total spending on these activities in the United States. Between 1987 and 2013, the commercial sector increased its R&D spending almost 200%. See e.g., "The Global Innovation 1000: Top 20 R&D Spenders 2005-2016," PWC Consulting, 2017. https://www.strategyand.pwc.com/global/home/what-we-think/innovation1000/top-20-rd-spenders-2016-interactive_only.

23. Senator John McCain, "Restoring American Power: Recommendations for the FY 2018-FY 2022 Defense Budget," January 2017, p. 19. https://www.mccain.senate.gov/public/_cache/files/25bff0ec-481e-466a-843f-68ba5619e6d8/restoring-american-power-7.pdf.

24. Paige Williams, "DIUx awards AI contract to help Air Force decision-making," *Defense News*, August 4, 2017. <https://www.defensenews.com/home/2017/08/04/diux-awards-ai-contract-to-help-air-force-decision-making>.

25. "DIUx Quarterly Report, Q3 2017," Defense Innovation Unit Experimental, June 30, 2017. <https://diux.mil/download/datasets/1329/DIUx%20Q3%20FY2017.pdf>.

defense companies to improve the targeting of terrorists.²⁶ Also, just a few weeks ago, it signed a \$1.5 million agreement with a Texas AI company to help the Air Force with its budget decision-making processes.²⁷ On that effort, the DIUx reportedly worked with the Air Force and several San Francisco-area software developers to turn that deal around in less than 120 days. With the benefit of special authorities that help it to speed the hiring of staff and the signing of agreements,²⁸ it has been working to reduce the amount of time necessary to finalize such deals from about 120 days down to 60. This is a considerable improvement on the three-to-nine months it can take the military services to execute contracts of similar size.²⁹ Such increased speed has been vital to attract outside sources of capital, and according to the DIUx, since it began, the 37 companies it has on contract account for roughly \$1.8 billion in venture capital funding.³⁰ So, in its efforts to help the DoD procure the needed combat capability, the DIUx is leveraging private-sector scouting, due diligence and financial investment.³¹

Notably, by the end of Fiscal Year 2017, the DIUx expects that it will transition its first pilot contracts into follow-on production³² and this will be the first time the DoD has ever done this under its “Other Transactions” (OT) authority.³³ Legal authorities provided by Congress permit successful OT pilot projects to serve as justification for follow-on production contracts without the need for further competition.³⁴ This is critical because it helps commercial innovation survive by letting almost anyone at the DoD purchase military capability successfully piloted through DIUx at scale, thereby circumventing the “valley of death” that often frustrates newer, innovative technologies from ever getting to the service members who need them.³⁵ For these reasons, during

an August visit to Silicon Valley, Secretary Mattis conveyed strong support for the DIUx and its mission.³⁶

Further, over the last two years, under the leadership of John McCain, Congress has enacted special authorities that have helped the DIUx operate as intended and has put in place other laws that help to ensure that the DoD has access to new sources of technological innovation developed by commercial companies not traditionally considered part of the defense industrial base. Among the most important of these provisions are those that provide for accountability for that vital mission by disestablishing the Under Secretary of Defense for Acquisition, Technology and Logistics (USD[AT&L]) and re-assigning its defense technological innovation duties to a new Under Secretary of Defense for Research and Engineering (USD[R&E]). As the Senate Armed Services Committee has observed, many years ago, those who previously served as USD(R&E) led the “Second Offset” strategy that succeeded in helping U.S. military technology exceed the Soviet Union’s. Likewise, Congress intends for the reinstitution of this office to drive technological innovation vital to a “Third Offset” strategy that includes cyber- and space-related capabilities, unmanned systems, directed energy, undersea warfare, hypersonics and robotics.³⁷

Other recently enacted provisions will further improve the DoD’s access to non-traditional commercial innovation through more streamlined and commercially based processes. This will be accomplished by improving authorities regarding rapid acquisitions and prototyping, streamlining regulations that govern commercial items and exempting the purchase of commercial off-the-shelf items from certain regulations that have impeded the DoD’s ability to attract and do business with non-traditional suppliers. As for intellectual property, other provisions require some new weapons programs to be designed—to the extent possible—with a modular open-systems approach and an associated acquisition strategy that lays out how IP and technical data deliverables will be addressed.³⁸ In the aggregate, these provisions are a positive step in the right direction, as they help to relax a regulatory environment that commercial suppliers have identified as overly burdensome.

Such developments are already yielding progress. For example, just this past summer, in connection with an experi-

26. Anthony Cappacio, “Pentagon’s Silicon Valley Unit Helps Target Terrorists,” *Bloomberg*, August 9, 2017. <https://www.bloomberg.com/news/articles/2017-08-09/pentagon-s-silicon-valley-unit-tweaks-software-to-hit-terrorists>.

27. See, e.g., Williams. <https://www.defensenews.com/home/2017/08/04/diux-awards-ai-contract-to-help-air-force-decision-making>.

28. See “S.2943: National Defense Authorization Act of Fiscal Year 2017,” Public Law 114-328, Dec. 23, 2016, §1105(b) [hereafter NDAA FY17].

29. For established timelines for new Army contracts, see: GAO Report 17-644, p. 13. <http://www.gao.gov/assets/690/686012.pdf>.

30. “DIUx Quarterly Report, Q3 2017.” <https://diux.mil/download/datasets/1329/DIUx%20Q3%20FY2017.pdf>.

31. *Ibid.*

32. *Ibid.*

33. “Other Transaction” authority allows the DIUx to work with industry outside of the standard procedure for government procurement contracts.

34. “DIUx Quarterly Report, Q3 2017.” <https://diux.mil/download/datasets/1329/DIUx%20Q3%20FY2017.pdf>.

35. *Ibid.*

36. Tom Simonite, “Defense Secretary James Mattis Envis Silicon Valley’s AI Ascent,” *Wired*, August 11, 2017. <https://www.wired.com/story/james-mattis-artificial-intelligence-diux>.

37. NDAA FY17, p. 5. https://www.armed-services.senate.gov/imo/media/doc/FY17_NDAA_Bill_Summary.pdf.

38. When a modular open system approach is used, another provision requires the DoD to obtain only “government purpose rights,” rather than “unlimited rights” in technical data pertaining to a major system interface developed exclusively at private expense, or partially with federal funds and partially at private expense. This is unless the Secretary of Defense determines that negotiating different rights would be in the national interest.

mental program at Holloman Air Force Base, the Air Force announced that it would use a new rapid acquisition plan that was recently authorized by Congress to procure light attack aircraft.³⁹ The potential for this newly bestowed authority to help the DoD rapidly acquire urgently needed IT-related products and services is especially promising.

Attracting outside investment and risk-taking

Over the last couple of years, initiatives pursued by the DoD and Congress have encouraged outside investors to support high-technology startups that develop products and services that can be applied to military use.⁴⁰ As described above, the speed with which the DIUx has been able to close out prototype agreements with non-traditional companies has already attracted outside sources of investment capital.⁴¹ An increasing number of VC firms, including Andreessen Horowitz, Franklin Templeton, Crosslink Capital, DFJ Venture Capital, Sequoia, Kleiner Perkins, Bessemer Venture Partners, Lightspeed Venture Partners and NEA Venture Capital have raised billions of dollars for technology-focused, middle-market companies that support government-related aerospace, defense and national security activities. Even traditional defense supplier Lockheed Martin has injected about \$20 million into technology startups in the past year alone.⁴²

In the past, the DoD employed small-scale venture capital or similar initiatives in the Silicon Valley through, for example, the Army and OnPoint Technologies in 2002 or the Defense Venture Catalyst Initiative in 2005. Throughout the 1960s and '70s, it also maintained a significant presence there through military contractors like Lockheed Missiles or the C.I.A.'s In-Q-Tel, which, with the support of outside venture capital, identified and invested early in big-data innovators like Cloudera and Palantir.

However, despite some surface similarities, what is happening today appears fundamentally different. Rather than being an *ad hoc* exercise, these developments are occurring in the context of a commercial procurement environment that has been significantly deregulated. And, more importantly, such an environment has become increasingly favorable to risk-taking by commercial startups wanting to develop emerging technologies that can be used for military purposes.

Critically, it has also become favorable to risk-taking by a highly motivated private investment community.

Also, unlike previous examples, these developments are occurring in the context of broader changes to the ways that the DoD approaches technological innovation, which are reflected in its reorganizational initiatives. Moreover, as DIUx has rightly observed, these developments also describe a cultural shift in how Silicon Valley is pursuing the DoD and the government more broadly as a viable business opportunity.⁴³ For example, since June 2016, seven DIUx portfolio companies have been able to raise roughly \$720 million in subsequent rounds of funding, partially due to their work with DoD.⁴⁴

In short, over the last three years and because of the DIUx's ability to operate in a deregulated commercial-procurement environment that has been secured by recent legislative reform initiatives, the DoD has been able to access key commercial emerging technologies. Such an alignment of the DoD, Congress and industry has created an overall environment that has welcomed high-tech companies and investors in those companies to do what they do best: take risks and innovate. In so doing, the DoD has been able to export "development risk" to the private sector, while procuring capabilities it vitally needs to maintain technological dominance over our adversaries. What's more, this is not only a description of the past—it is a prescription for the future.

POLICY RECOMMENDATIONS

Whether the DoD will be able to leverage emerging dual-use technologies from non-traditional suppliers to address military capability gaps will depend upon its ability to manage an ecosystem that permits such suppliers and their outside investors to extract the necessary benefits.⁴⁵ This will undoubtedly be a challenging, new experience for the DoD and with this in mind, it will be important for it to pursue, among other things, the following initiatives.

Develop a comprehensive strategy and realign resources accordingly

First, as commentators have observed, the DoD should develop a "comprehensive technology development and investment strategy" and realign its resources to priorities in furtherance of that strategy.⁴⁶ Further, they argue that

39. Jacqueline Devine, "Air Force conducts light attack experiment at Holloman," *Alamogordo Daily News*, August 10, 2017. <http://www.alamogordonews.com/story/news/local/community/2017/08/10/air-force-conducts-light-attack-experiment-holloman/558137001>.

40. Examples include funds managed by Andreessen Horowitz, Franklin Templeton, Razorback Capital, The Boeing Company and Lockheed Martin.

41. "DIUx Quarterly Report, Q3 2017." <https://diux.mil/download/datasets/1329/DIUx%20Q3%20FY2017.pdf>.

42. Sandra Erwin, "Defense Industry in a Race to Buy Hot Startups," *RealClearDefense*, July 3, 2017. https://www.realcleardefense.com/articles/2017/07/03/defense_industry_in_a_race_to_buy_hot_startups_111715.html.

43. "DIUx Quarterly Report, Q3 2017." <https://diux.mil/download/datasets/1329/DIUx%20Q3%20FY2017.pdf>.

44. Ibid.

45. These would include, for example, cash-flow and a reasonable return on invested capital.

46. Stephen Rodriguez et al., "America Needs a New 'Dreadnought Strategy,'" *Foreign Policy*, July 28, 2017. <http://foreignpolicy.com/2017/07/28/america-needs-a-new-dreadnought-strategy-military-technology-rd>.

it should also consider the opportunities of and threats to American research technology, weigh the context of the strategic threat environment and evaluate whether it is prudent to develop or delay the official release of a technology in the face of adversaries eager to incorporate any related advances into their own defense systems.⁴⁷ Finally, they note that China's success in investing in, testing and accelerating the deployment of military-grade capabilities in the commercial market should serve as a basis for this recommendation.⁴⁸

However, such a strategy must also be sufficient to ensure continued innovation in all emerging technologies that have been identified as strategically important, particularly AI. More broadly, educating and attracting talent in identified technologies should be prioritized and it should be ensured that adequate R&D investment is made—both in startups and in the long term. From the DoD's recent report to Congress on restructuring its acquisition, technology and logistics organizations, it appears that this responsibility will reside with the USD(R&E), which is a positive development.⁴⁹

Implement recent reforms, as intended

Second, the DoD should implement Congress' recent reform legislation in a manner that comports with Congress' intent. As briefly discussed above, one of the legislative reforms recently enacted by Congress was the disestablishment and separation of the position of Undersecretary of Defense for Acquisition, Technology and Logistics (AT&L) into two directorates—an Undersecretary for Acquisition and Sustainment, (USD[A&S]), and an Undersecretary for Research and Engineering, (USD[R&E]). These changes will be effective next February. As the Director for Defense Pricing Shay Assad correctly observed, this initiative presents the DoD with a tremendous opportunity “to be innovative and creative and empower and enable the services to get their jobs done.”⁵⁰ However, as Assad also noted, the DoD's preliminary reorganization plan does not go nearly far enough.⁵¹

This is because the DoD's current proposal appears largely to rearrange existing roles and missions in a way that arguably remains too moored in the status quo. If progress is to occur, however, the changes that it ultimately makes must 1) make sure that access to commercial innovation is consistently viewed as a priority throughout the defense enterprise—particularly within the military departments; and 2)

in cases where a validated operational requirement is open to commercial solutions, it must ensure an effective hand-off of the relevant commercial developmental technology in a way that *empowers and enables the military services to procure and field needed military capability*.⁵² Under Congress' recent reform legislation, the center of gravity in investment decision-making on the Pentagon's largest and most expensive procurement programs will reside within the military departments instead of with the Secretary of Defense. Accordingly, the military departments must be empowered to make the right decisions on these programs, so that they can be held accountable when they do not—subject, of course, to effective congressional oversight.

Appoint the right people with the right authority

Similarly, with the advice and consent of the Senate, the DoD must make sure that the right people are appointed to the right positions, and that they have the necessary authority and resources to do their newly-created jobs effectively. For this new technological innovation paradigm to work, the particular person appointed to serve as USD(R&E) will be of key importance. In the conference report that accompanied the Fiscal Year 2017 Defense Authorization Act that created the position, the conferees noted that they expect that, as the “chief technology officer,” the USD(R&E) would have the stature and resources to drive innovation throughout the department, by developing and implementing innovative policies and practices—particularly alternative pathways that accelerate the delivery of superior technologies across the acquisition spectrum.⁵³ But, as the conferees of the defense authorization bill noted, the USD(A&S) must be prepared to challenge any advanced technology ideas that the USD(R&E) cannot confidently deliver within the agreed cost, schedule any performance objectives and must help to shape those priorities appropriately. Recognizing that this relationship may give rise to “special challenges,” the DoD correctly noted in a recent report to Congress that its reorganization of the USD(AT&L), USD(R&E) and USD(A&S) will minimize these challenges through improved process and planning, communication and effective leadership. Clearly, those who serve in these roles will have to be among the very best managers and they will require the full support of the Secretary of Defense.

Implement commercial procurement reforms

Also, as Congress intended, the DoD must implement the recently enacted commercial procurement reforms, which

47. Ibid.

48. Ibid.

49. NDAA FY 2017, §901, pp. 7-8. https://www.armed-services.senate.gov/imo/media/doc/FY17_NDAA_Bill_Summary.pdf.

50. Justin Doubleday, “Pricing chief calls for more imaginative reorganization of acquisition office,” Inside Defense, August 30, 2017. <https://insidedefense.com/inside-pentagon/pricing-chief-calls-more-imaginative-reorganization-acquisition-office>.

51. Ibid.

52. This would reflect an important feature of the Department of Homeland Security's (DHS's) Procurement Innovation Lab, which (with no offices and few staff) maintains a “virtual” presence that helps it facilitate efforts by various internal agencies to rapidly procure technologically innovative capability.

53. NDAA FY 2017, §901, p. 6. https://www.armed-services.senate.gov/imo/media/doc/FY17_NDAA_Bill_Summary.pdf.

were meant to help improve DoD's access to commercial innovation through more streamlined processes akin to those encountered in the commercial marketplace. Among these reforms are provisions enacted in the Fiscal Year 2016 Defense Authorization bill that provides guidance related to commercial items and price reasonableness determinations. Others require the Secretary of Defense to establish and maintain a centralized way to oversee commercial item determinations, market-research and price-reasonableness analysis for DoD procurements. Further, in the Fiscal Year 2017 bill, Congress enacted a number of reforms that related to DoD commercial procurements, including a provision that establishes a preference for certain commercial services and another that generally requires DoD to use commercial (or non-government) standards rather than military ones.

If, as it should, the DoD relies on the commercial marketplace as a source of technological innovative products and services that it can adapt for military use, then it must implement these rules and regulations in a manner that engenders risk-taking by technological startups and their investors. As a threshold matter, this requires that the DoD promote consistency and fairness in how it makes commercial-item and price-reasonableness determinations.

There is reason for optimism. In their confirmation hearings, Deputy Secretary of Defense Patrick Shanahan and Undersecretary of Defense for Acquisitions, Technology and Logistics Ellen Lord agreed that using and supporting the full range of new tools and authorities the DoD now has to acquire and adapt new commercial technologies will be vital to helping the DoD to retain military technological dominance.⁵⁴ Specifically, Undersecretary Lord committed to reinvigorating research and engineering innovation by “utiliz[ing] the authorities provided in the ‘16 and ‘17 National Defense Authorization Act, as well as those proposed in the ‘18 NDAA.”⁵⁵ While Undersecretary Lord rightly cautioned that “[r]eform will not happen in just six or twelve months,” she reassured Chairman McCain that “a path can be set and progress made” and that “[these] efforts [would] be transparent and communicated early and often.”⁵⁶ Also encouraging are efforts by the Director of Defense Pricing and the Director of the Defense Contract Management Agency (DCMA) Cost & Pricing Center to work with relevant companies to develop memoranda of agreement that define the types of

information needed to support commercial-item and price-reasonableness determinations.

Within the military departments where the center of gravity for investment decision-making for major weapons procurement will reside, one can find optimism in Air Force Chief of Staff General David Goldfein's recent observation about AI that “the marriage between where industry is going and the innovation that we see coming out, and where there are military applications to allow us to [leverage that innovation], is as exciting as anything else I'm looking at.”⁵⁷ More compelling is Army Chief of Staff Mark Milley's recently announced initiative to dramatically improve the Army's acquisition system to make it more agile *vis-à-vis* its modernization priorities.⁵⁸

Develop and track performance metrics

Bearing in mind that one can only manage what one measures, the DoD should develop and track performance metrics from early-stage, venture-backed companies that develop dual-use technology. The DoD should also put in place related metrics that measure, for example, how effectively the DoD actually is in adapting these commercial technologies for military use and to what extent those items successfully satisfy an actual operational requirement. Another metric might measure whether the overall effort involved with such procurements actually reduces field deployment time and drives down acquisition and sustainment cost, as compared to former military solutions. When the military departments become open to procuring commercial dual-use technologies and use them to successfully address urgently needed military capability, the data should reflect a concomitant increase in the use of new acquisition pathways, rapid capabilities offices and reliable acquisition approaches like developmental prototyping and experimentation. These will indicate that we are moving in the right direction.

Ensure the appropriate congressional oversight

Finally, vigilance may be warranted with respect to how the federal government, particularly the DoD Inspector General (IG) and the Department of Justice, extend remedies to non-traditional commercial suppliers that are available to the government in cases where it suspects that a government contractor has excessively priced a product or service. Although some have complained that the DoD's IG has taken an unduly aggressive posture with defense contractors that

54. See “Statement of Ellen M. Lord Nominee to be Under Secretary of Defense For Acquisition, Technology and Logistics,” *Senate Armed Services Committee*, July 18, 2017, pp.1-2. https://www.armed-services.senate.gov/imo/media/doc/Lord_07-18-17.pdf. In her written testimony, Ms. Lord committed to: drive innovation to regain our nation's technological edge while focusing on affordability and accountability” and “work to streamline the acquisition and sustainment processes while reinvigorating research and engineering innovation” (p. 1). As Ms. Lord asserted, “an 80-percent solution, rapidly delivered, is typically far more useful than an elegant solution delivered late” (p. 2).

55. *Ibid.*

56. *Ibid.*

57. Oriana Pawlyk, “Air Force Needs AI, Better Technology to Gather Intel: Goldfein,” *DefenseTech*, July 27, 2017. <https://www.defensetech.org/2017/07/27/air-force-needs-ai-better-technology-gather-intel-goldfein>.

58. See, e.g., Sydney J. Freedberg, Jr., “Milley Announces Biggest Buying Shift in 40 Years: Army Will Get Weapons the SOCOM Way,” *Breaking Defense*, October 9, 2017. <https://breakingdefense.com/2017/10/milley-announces-biggest-buying-shift-in-40-years-army-will-get-weapons-the-socom-way>.

provide commercial items, further ambiguity has arisen from the Supreme Court's decision in *Universal Health Services v. United States ex rel. Escobar*,⁵⁹ under which a government contractor can be found criminally liable under the False Claims Act even if it submitted a facially accurate invoice to the government. Given how important continuing access to emerging technologies is to national security, close congressional oversight of these issues will be necessary to ensure that DoD's interactions with commercial suppliers engender fair play.

CONCLUSION

Today, the most exciting innovations in technology come from commercial companies that reside outside of the defense industrial base. Yet despite great potential for the use of these technologies within the military, many have not traditionally been accessible to the DoD.

Thankfully, over the last few years, thoughtful initiatives pursued by the DoD and Congress, as well as VC and angel investors have deployed billions of dollars across scores of deals in early-stage companies to develop dual-use technologies. As a result, new outside investors have already identified and supported early-stage companies at the forefront of industrial technologies that are adaptable for military use and have committed to partnering with these companies throughout their life cycle. Thus far, they have done so without the DoD being required to seed any development money or incur any development risk. With this in mind, all laws, rules and policies that impact the ways that the DoD procures commercial products and services and their implementation must adapt to maintain and improve upon these trends.

Allowing the free market to export development risk and leverage the VC and angel investment community as a means to scout, conduct due diligence on and financially invest in the most promising startups can be a powerful tool that can help the DoD drive down development risk, ensure affordability and guarantee timely deployment of needed capability. It can also allow the DoD to embrace some of the most encouraging developments in the area of defense procurement policy seen in a generation, and to maintain its position as the most technologically sophisticated fighting force in the world.

ABOUT THE AUTHOR

Pablo E. Carrillo serves as Of Counsel in the Defense and Maritime Security Public Policy practice group at international firm Squire Patton Boggs; as a Government Fellow with the Geneva Centre for Security Policy, Global Fellowship Initiative; and on the Board of Directors for the R Street Institute. Previously, he served under U.S. Senator John McCain (R-Ariz.) as his Chief of Staff and Minority General Counsel at the U.S. Senate Armed Services Committee. The views expressed herein are those of the author and should not be understood to reflect those of his former or current employers.

59. "Universal Health Services v. United States ex rel. Escobar," ScotusBlog, 2017. <http://www.scotusblog.com/case-files/cases/universal-health-services-v-united-states-ex-rel-escobar/>