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Department of Defense Emerging Technology Strategy: A Venture Capital Perspective

James Cross—The Atlantic Council

Abstract

The purpose of this paper is to assess the DoD's efforts to access new sources of innovation through engagement with venture-backed emerging technology companies by analyzing dual use venture funding flows. The intended audience is threefold: DoD innovation policy makers, members of innovation units deployed to emerging tech ecosystems, and their overseers and financial backers in Congress.

The first section analyzes five years of dual use venture funding activity. The encouraging conclusion is that, at least on the surface, DoD efforts have been successful: Venture funding to dual use companies the last five years has tripled from around $5 billion to nearly $15 billion. However, a deeper look shows that the DoD overly focuses on the Early Stage segment of the market. The corresponding geographic analysis of venture flows in 2018 also shows an incomprehensible lack of engagement in Silicon Valley.

The second section lays out a multi-stage throughput model for dual use venture activity. A better familiarization by innovation leaders will effectively calibrate policy, capital, and personnel to the venture market, driving stronger outcomes for the warfighter. The third section offers a set of metrics detailed at each VC funding stage to assess the effectiveness of DoD innovation engagement.

Preface

It is generally accepted that the United States has entered a new geopolitical phase that equates to a Digital Arms race, primarily with China. Silicon Valley conceptually stands at the front lines. Whoever harnesses the newest technology for geoeconomic purposes wins. So, it would seem natural then that the DoD would send "soldiers to the front" to secure these new technologies for the warfighter.

To that end, a four-star COCOMM commander met with a group of 20 dual use VCs early in 2019 to explore commercial space options for his new multi-decade modernization program. Thirty minutes into the meeting, it became apparent, however, that no one in the room had seen his Broad Area Announcement calling for emerging tech ideas—no one, that is, except the VC rep from a prime contractor.

Four-star generals aren't the best choice for foot soldiers in this new digital conflict. The DoD needs a better strategy.

Introduction

The DoD has officially shifted focus from counter-terrorism (CT) to Great Power Competition (GPC), as described most prominently in the Trump Administration's 2018 National Defense Strategy: "Inter-state strategic competition, not terrorism, is now the primary concern in U.S. national security" (DoD, 2018). Observers such as the media, industry analysts, and academics have begun talking about the new "Digital Arms Race" with China, or the new "Cold War II" with Russia and China. "U.S. Scrambles to Outrun China in New Arms Race," proclaimed the New York Times newspaper headline on January 27, 2019 (Sanger et al., 2019). Defense leaders speak of the digitization of warfare. The three traditional domains, Air, Sea, and Land, have now been expanded to the realms of

Space, Cyber, and Information. The Russians refer to the latter as “hybrid warfare,” a term trumpeted by General Gerasimov, Russia’s chief of the General Staff (Baig, 2019).

Recent DoD strategy documents decry a “digital gap” that has emerged between the United States and its adversaries in these new domains. A variety of efforts have begun to work towards closing that digital gap. Much of these efforts center around improving defense innovation and strengthening the National Security Innovation Base. Policy statements, new budget authorizations, and the development of novel DoD innovation outreach units are all aimed at accelerating the closure of this perceived gap.

The implied goal of these efforts is to better facilitate the United States in its competition with its Near Peer competitors by developing new sources of emerging technology. Secretary Mattis described this goal succinctly at the 2018 Reagan Defense forum: “Our will to win is not more important than our will to prepare to win. This includes warfighting excellence from our military, steady predictable funding from Congress, and engaged support from our most innovative industry leaders, including Silicon Valley” (Mattis, 2018).

Mattis’ statement begs the question, then, what exactly is “Emerging Tech;” with a $60 billion R&D budget, why does the DoD need it; and how does the DoD get more of it from Silicon Valley?

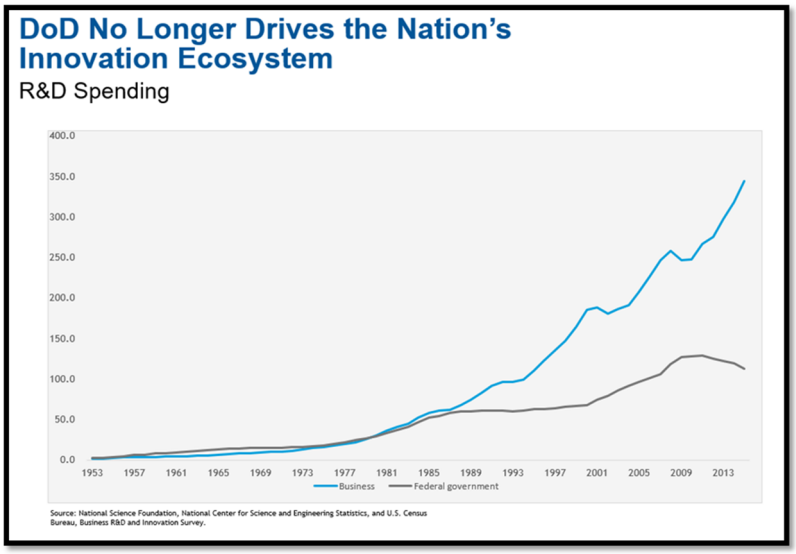

Figure 1. DoD No Longer Drives the Nation’s Innovation Ecosystem

The two most likely new sources, then, would be tech developed by the new “Tech Titans,” such as Google, Amazon, and Facebook and/or early stage emerging technology companies backed by venture capitalists. These two sources could reasonably be lumped into the DoD’s rhetorical innovation category of “Silicon Valley” given either their geographic HQ locations and/or their sources of funding originating from Sand Hill Road (the geographic center of the vast preponderance of tech venture capital).

So, the DoD is deploying resources, in terms of “boots on the ground” and dollars, to access these sources of emerging tech that their current/traditional sources of technology don’t offer through the establishment of new innovation units such as the DIU, AFWERX, and Army Futures Command (AFC). From the standpoint of a defense technology venture investor based in Silicon Valley, these units’ strategy and mission are obvious. Defense

innovation policy makers are less sure of these units' mission and strategy. This is obvious considering, for example, that the DIU has had three executive directors in two years (four if you count the acting executive prior to Mike Brown [Elias, 2018]) and seen its funding cut multiple times by the appropriation committees (Williams, 2018).

From a Silicon Valley investor standpoint, the DoD should drive forward on three lines of effort to effectively engage venture-backed emerging technology companies:

1. Startups: To inspire potential founders to quit their day jobs and start that company they always dreamed of. Also, to develop an initial business model that includes selling to the government (dual use).
2. VC Funding: To help attract venture capital towards these dual (or single) use start-ups across all stages, sectors, and geographies.
3. Policy: To drive policy changes that enable the services to be more effective consumers of these new technologies at each start-up lifecycle stage with the ultimate goal of getting Late Stage emerging tech companies on Programs of Record (or the R&D/O&M equivalents).

2014–2018 Dual Use Venture Fund Flows

The effectiveness of DoD innovation engagement is difficult to measure qualitatively. The various outreach units act in an uncoordinated (and often conflicting) manner; no unit has a clear national leadership role, funding levels for the various units are inconsistent, and the uniformed services have yet to fully get involved. Quantitative measurements are much easier. A survey of publicly available venture funding in dual use categories shows that despite the DoD's miscalibrations, it is succeeding in attracting private capital. Figure 2 shows the excellent growth in dual use funding over the last five years.[1]

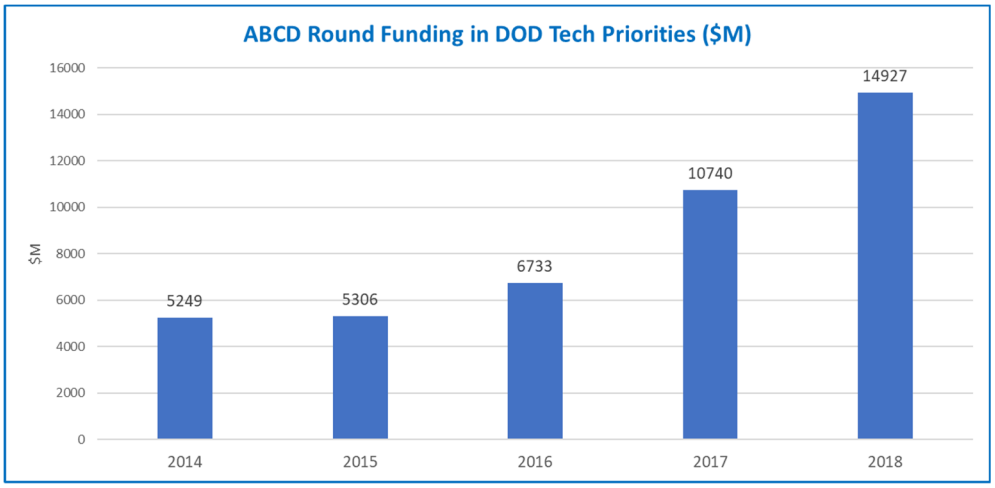

Figure 2. ABCD Round Funding in DoD Tech Priorities

[1] Unless noted, all venture funding data is sourced from Pitchbook with full documentation in the reference list.

Also encouraging is that the DoD has roughly held its share of VC funding steady at around 20% (see Figure 3).

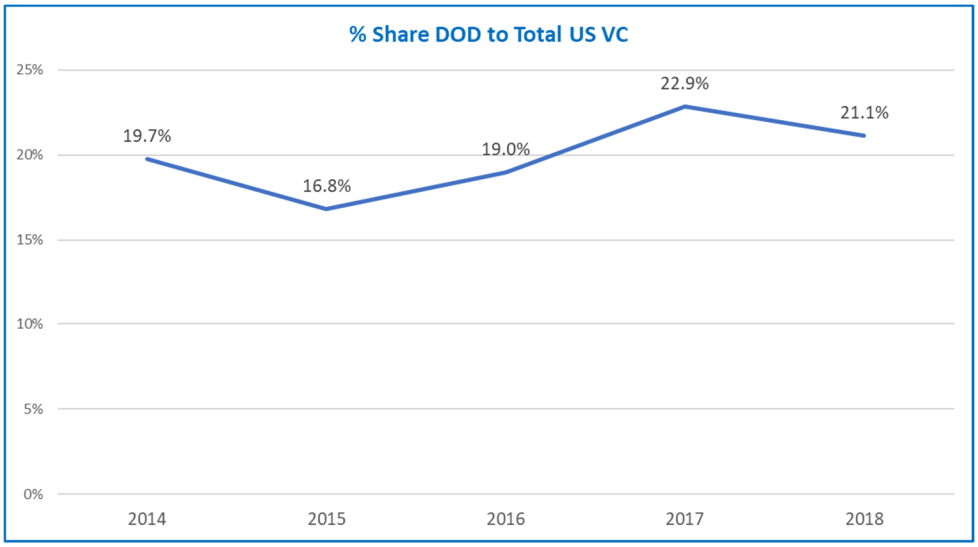

Figure 3. Percentage Share of DoD to Total U.S. VC

Looking at the 2018 dual use venture funding by round reveals insights that will better shape innovation strategy. As Figure 4 shows, whether by intent or not, A and B Round funding is rather robust. However, the levels drop in the Late Stage, illustrating the need to shift focus.

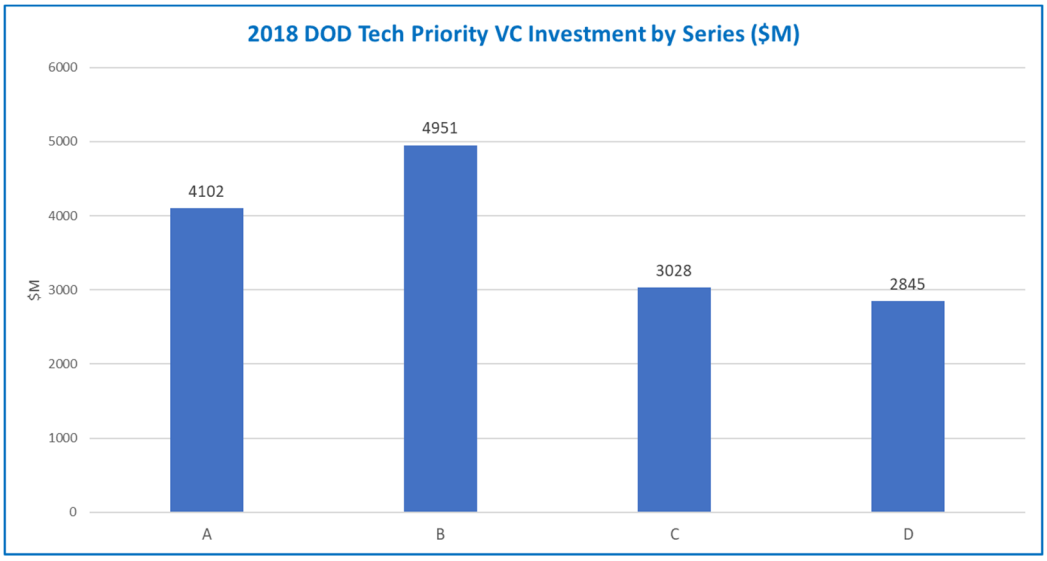

Figure 4. 2018 DoD Tech Priority VC Investment by Series

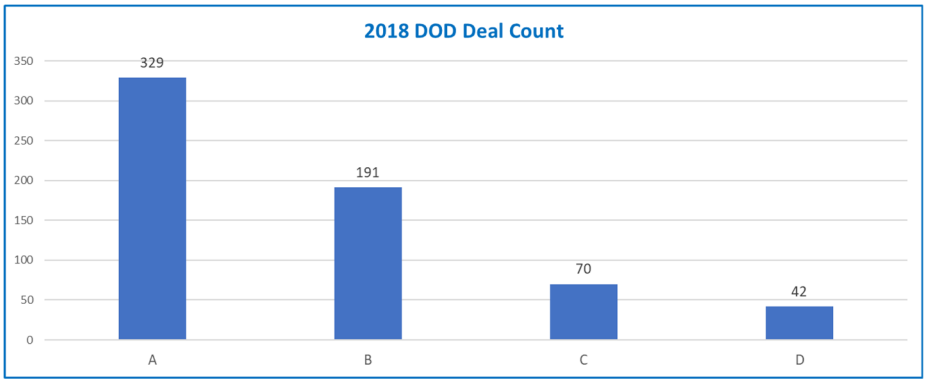

Figure 5. 2018 DoD Deal Count

2018 Dual Use Venture Activity by Region

Table 1 shows 2018 dual use venture activity by region and funding stage. Table 2 compares DoD innovation unit budgets to venture activity by region.

One immediate conclusion jumps off the page: Silicon Valley completely dwarfs all other regions. Similarly, from the second chart, DoD innovation is significantly over-indexed to the National Capital Region (NCR) and extremely under-indexed to Silicon Valley. SV had 57.5% of 2018 dual use venture flows. However, the DoD only allocates 3.7% of its VC-backed innovation engagement budget there, with just a single unit deployed there. The DIU needs a massive resource increase as the only unit based in Silicon Valley. The NCR gets 91% of DoD budgets with a mere 2.6% of venture funding. Lastly, the AFC's selection of Austin for its HQ implies other priorities for the unit than engagement with venture backed companies. Texas only saw 2.7% of venture funding in dual use categories last year.

Table 1. 2018 Dual Use Venture Activity

2018 Dual Use Venture Activity by Region								
					Funding Round			
Region	Dollars (MM)	% of Total $	Deal Count	% of Total #	A	B	C	D
NCR	374	2.6%	24	3.9%	13	9	1	1
Midwest	392	2.7%	24	3.9%	15	5	2	2
New England	1316	9.0%	76	12.4%	42	23	7	4
New York	1825	12.5%	62	10.1%	28	24	7	3
Northwest	53	0.4%	7	1.1%	4	3	0	0
Rocky Mountains	175	1.2%	13	2.1%	6	4	3	0
Silicon Valley	8414	57.5%	290	47.4%	152	76	41	21
Southeast	308	2.1%	18	2.9%	8	8	0	2
Southern California	1102	7.5%	58	9.5%	26	24	6	2
Southwest	287	2.0%	14	2.3%	10	3	1	0
Texas	389	2.7%	26	4.2%	13	8	1	4
Totals	14635		612		317	187	69	39

Table 2. DoD Innovation Unit Budget

2018 DOD Innovation Unit Budget by Geography vs VC Funding Flow					
	VC Dollars		DOD Dollars		
Region	Dollars (MM)	% of Total $	Dollars (MM)	% of Total #	Innovation Units (HQ)
NCR	374	2.6%	1755	91.0%	SCO, MD5, JAIC, NavalX
Midwest	392	2.7%	0	0.0%	
New England	1316	9.0%	0	0.0%	
New York	1825	12.5%	0	0.0%	
Northwest	53	0.4%	0	0.0%	
Rocky Mountains	175	1.2%	2	0.1%	CYBERWERX
Silicon Valley	8414	57.5%	71	3.7%	DIU
Southeast	308	2.1%	0	0.0%	SOFWERX (no public budget data avail)
Southern California	1102	7.5%	0	0.0%	
Southwest	287	2.0%	0	0.0%	AFWERX
Texas	389	2.7%	100	5.2%	AFC
Totals	14635		1928		

All the data relating to venture funding in this paper, unless otherwise noted, is targeted at DDRE Griffin's 10 tech priorities for the DoD (Acquisition in the Digital Age [AiDA]—MITRE, n.d.).

Case Study: AI/ML

Artificial Intelligence/Machine Learning (AI/ML) stands as a compelling case study candidate for a variety of reasons. Highest among those is the fact that the White House (Trump, 2019) and the DoD (2019) just released strategy papers, the Joint Artificial Intelligence Center was recently launched under General Shanahan (Cullum, 2018), and the category represents a huge amount of dual use venture funding (65.6% in 2018). This case study illustrates how the analysis of venture funding by stage and source better informs DoD innovation strategy.

AI/ML funding is showing immense growth and taking a steadily increasing share of venture funding (see Figure 6), all good news for the DoD's AI ambitions. Venture investors have poured billions into AI/ML deals. The total from 2014 to 2018 according to Pitchbook stands at $22.6 billion. This number alone clearly shows the DoD should focus on partnering with existing dual use AI start-ups rather than creating new ones.

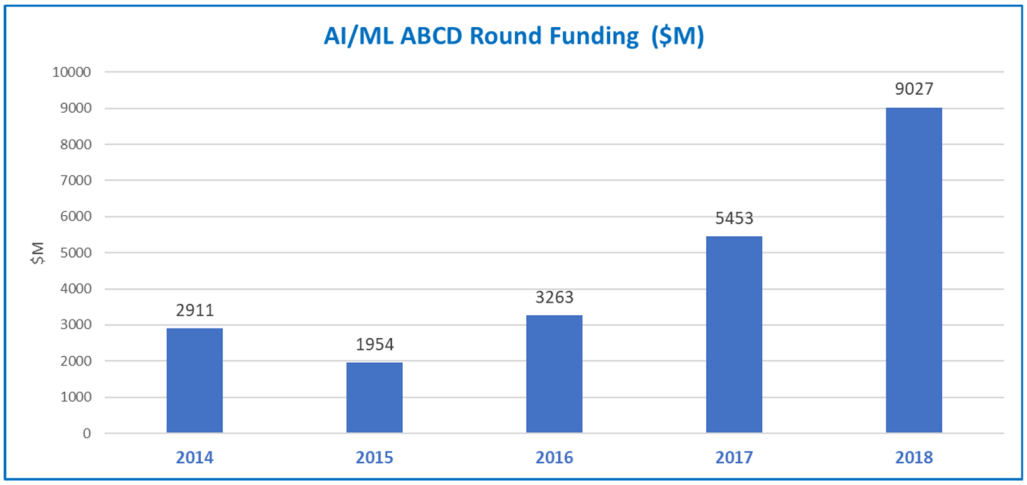

Figure 6. AI/ML ABCD Round Funding

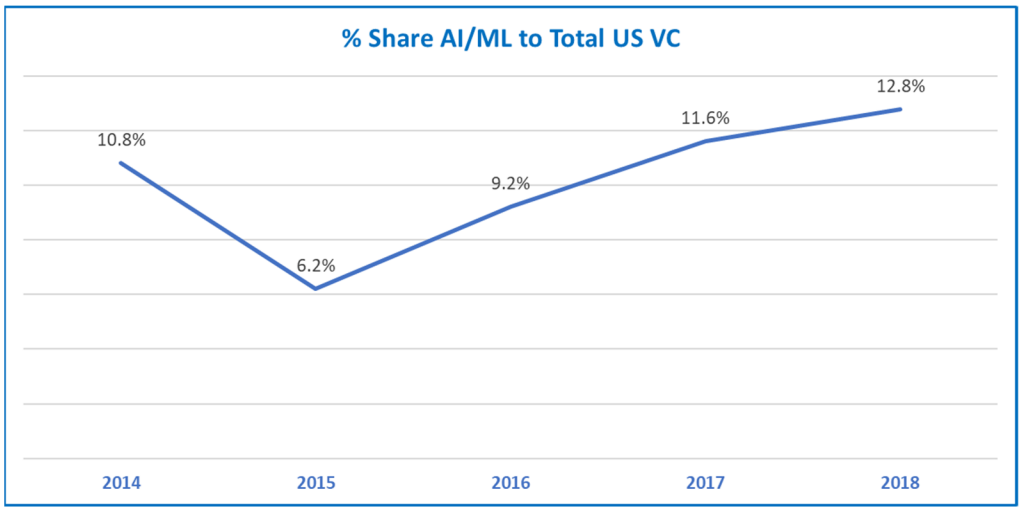

Figure 7. Percentage Share of AI/ML to Total U.S. VC

However, a closer look at 2018 funding data shows a more nuanced story. While A and B Round funding remains healthy, Late Stage funding drops dramatically (see Figure 8). AI technology has yet to find revenue-rich markets, making Late Stage funding difficult. This represents an opportunity for the DoD to aggressively compete for the attention of A and B Round companies with large procurements without onerous compliance and accounting requirements, thereby potentially attracting Late Stage funding that is currently sitting on the sidelines.

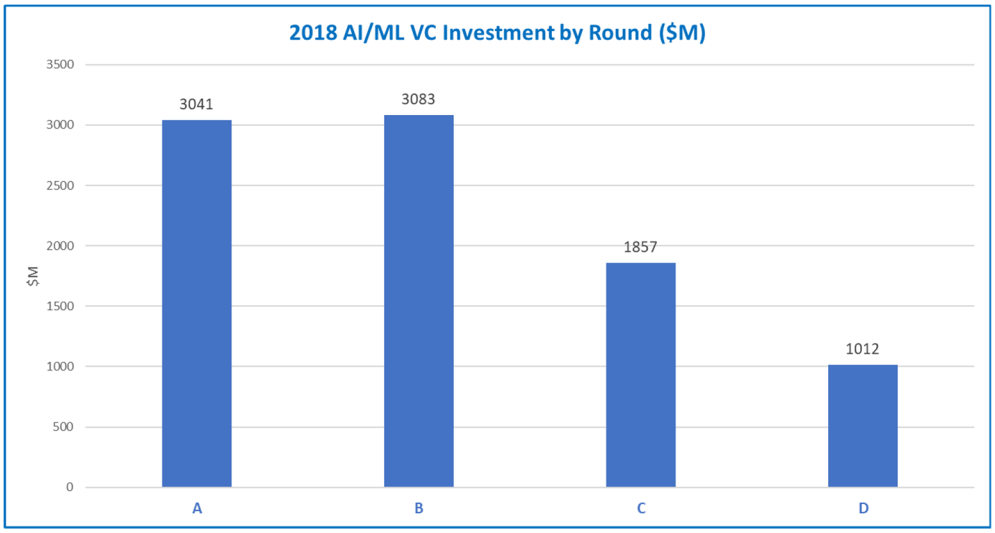

Figure 8. AI/ML VC Investment by Round

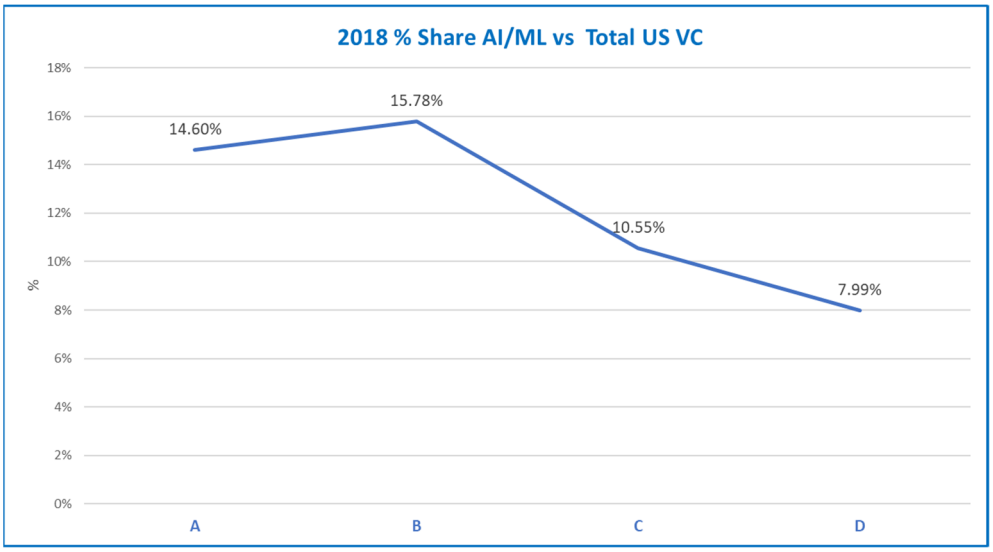

Figure 9. Percentage Share AI/ML vs. Total U.S. VC

Those efforts to woo capital and start-ups in AI should center around the West Coast. According to CB Insight's 4Q18 venture reports (PitchBook, 2019), the top five states for AI deals in the quarter were

- CA: 53 deals, $1.9 billion invested
- MA: 13 deals, $247 million invested
- NY: 10 deals, $110 million invested
- TX: 3 deals, $10 million invested
- WA: 3 deals, $9 million invested

Again, this illuminates Army Future Command's decision to HQ in Austin. Naturally, proximity to testing ranges and resources at Fort Hood supports that move, but the lack of AI/ML start-ups does not. The recent spate of NYC-based DoD AI/ML hackathons also don't make sense from a geographic analysis.

A Venture Capital Map of the National Security Innovation Base

Better policy and innovation partnerships would flow easier if the DoD side better understood the structure and process of the people (venture being relationship-driven) they are trying to partner with, especially considering that the DoD needs Silicon Valley more than Silicon Valley needs the DoD. The goal of this section, then, is to increase the effectiveness of DoD innovation efforts by decreasing the awkwardness of its efforts to attract innovation. Metaphorically, stop stepping on your dance partner's shoes by actually learning the dance.

Following is a highly simplistic model that captures the life stages of a venture backed dual use start-up as it progresses through the innovation ecosystem, describes the relevant issues for DoD support of that process at each stage, and recommends policies for improvement thereof. In the next section, the paper will then offer a basic framework for measuring the effectiveness of the DoD's efforts in stimulating greater output of dual use companies from this ecosystem.

Many of the terms and acronyms will be defined in the following section. However, a few definitions up front are necessary:

- Start-Up Stage—the general timeframe and lifecycle in which the start-up is currently operating. Innovation policy needs to fit each stage; one size does not fit all.
- VC Funding Round—the specific funding round that the start-up either most recently completed or is working to fund. These rounds somewhat fit the start-up stages, but not perfectly. The key is that as the start-ups move through their life stages, their funding round sources and milestones shift. Policy should fit appropriately.
- Sand Hill Road—the geographic location west of Stanford University in Palo Alto, CA, where the vast majority of the leading venture capital firms are located, especially those capable of writing large, late stage checks. The term "Sand Hill Road" is also often used as a metaphor for traditional venture funding.
- MVP—Minimum Viable Product, the goal of an early stage start-up, which is to go through multiple customer engagements as it defines its MVP, then build a business model. Many policy makers mistakenly confuse the order: MVP first, then detailed business model.
- DoD Innovation Units—DIU: Defense Innovation Unit; AFC: Army Futures Command; AFWERX: Air Force innovation outreach unit; SOFWERX: Special Operations Forces innovation, outreach unit; MD5: National Security Technology Accelerator; H4D: Hacking for Defense. This purposely excludes traditional DoD innovators such as DARPA, AFRL, NRO, etc.

DoD Innovation Outreach Ultimate Goal

In the interest of starting with the end in mind, the ultimate goal of DoD innovation efforts should first be defined. As referenced in the introduction, the obvious answer to that question is threefold from the perspective of a Silicon Valley venture investor: to motivate more founders to launch dual use start-ups, attract an increasing amount of private capital to fuel those start-ups' growth, and develop better policy to enable the services to deploy the technology from these companies. Or more simply put, the goal of DoD Innovation is to increase the number of "Dual Use Unicorns"[2] like Palantir, SpaceX, Cloudflare, Tanium, C3IOT, etc., by an order of magnitude.

While the DoD may not care about helping start-ups make unicorn status, only the larger Late Stage companies can handle the onerous requirements of full Federal Acquisition Requirements. In addition, the venture funders will require large exits at the Late Stage to continue finding dual use companies in the long term. Successful exits renew the innovation ecosystem. They are the key to driving the self-funding nature of the venture market. The proceeds of the exit go to the VCs who often re-invest them in earlier stage deals. As the number of successful exits grows, the amount of capital available in that ecosystem grows over time as well. For example, according to Crunchbase, a leading source of start-up financing data, the average successful startup raises $41 million in capital and exits for an average of $242.9 million (Lapowsky, n.d.). So, the DoD stands to benefit from a growing, self-funded source of new technology.

[2] A "unicorn" is Silicon Valley vernacular for a private (pre-IPO) venture backed company whose last financing round was conducting at a valuation exceeding $1 billion.

Creating Late Stage winners is easier said than done. In 2018, VCs funded 317 A Rounds but only 39 D Rounds. However, the DoD can boost the number of D Rounds if it properly aligns its current outreach units and budgets more effectively by stage, sector, and geography.

To do that, leadership needs to first understand the unique issues involved in supporting a start-up through its journey from Day 1 to Exit. It's generally understood in the Valley that the average time from start-up Day 1 to Exit is around seven years (Abdullah, 2018). Exact data on that number is difficult to measure with perfect accuracy because much of the data in the early stages is inconsistently self-reported. As discussed later, the data becomes much more reliable around the A Round.

Defining Foundational Venture Stage Concepts

Start-Up Lifecycle Stages: The lifecycle of a start-up proceeds in stages. These are generally referred to as Early, Mid, and Late Stage. Venture Capital firms often define their investment strategies by these stages. For example, Bessemer is known as a Mid Stage firm with emphasis on B Rounds, whereas Technology Crossover Ventures is very Late Stage focused, writing checks into five+ year old start-ups near their exits. The stage focus dictates what size of fund these VCs raise.

The average check size of an Early Stage Seed fund in 2018, according to Pitchbook, was $1.8 million. A venture fund normally targets 10–15 deals in its 7–10-year life. Thus, a Seed fund would need to raise around $20–50 million for the handful of partners to effectively deploy the fund in a timely manner.

Short Funding Stages Enforce Speed: Each stage usually holds one to three financing rounds. To move through these rounds, the start-up needs to achieve certain milestones. Funding rounds are usually spaced 12–18 months apart. Investors fund just enough cash in each round for the company to work towards its milestone, enabling the solicitation of the next funding round at a higher valuation. This structure drives the impressive speed in technology development which attracts the DoD—the start-up team either hits its milestone or goes "cash out."

Founders' Equity Incentivizes Speed: The other driver of start-up speed is the incentive of the equity ownership. The founders stand to make a tremendous amount of money through their equity holdings if they get to a successful exit. Thus, they are willing to take extremely low cash compensation and run a very lean operation. This second feature of start-ups is also attractive to DoD innovation goals. Traditional DoD R&D development programs are often very slow and end up wasting billions, as was the case with the Army's Future Combat System program.

Key Funding Milestones: For a start-up to obtain its next funding round, it must first achieve the key milestone enabled by its current funding round. DoD innovation policy makers should a have rudimentary understanding to better align resources by stage.

The key milestone in each stage evolves as the company grows. In the Early Stage, according to the work of leading start-up theorist and Stanford professor Steve Blank, the company is searching for its Minimum Viable Product (MVP; Blank, 2013) while building out the team beyond the first founders (usually one to three, with more than five being relatively rare). In the Mid Stage, the company raises more money to build the MVP into a full featured product ready for general availability with a full-fledged business plan and revenue model. In the Late Stage, the company raises even more money, often upwards of $100 million or more, to scale business towards an exit by hiring a large sales force and launching a comprehensive marketing campaign with the goal of ensuring a profitable exit.

The DoD needs to meet start-ups at each of their life stages with the right combination of customer engagement and financial support that helps the companies move more effectively towards their next funding round, yet this assistance must also be supportive of the ultimate exit.

For instance, the start-up's board of directors will often reject early stage Non-Recurring Engineering (NRE) money from a DoD source if they don't see a pathway from that activity towards a full Program of Record opportunity. The NRE may seem nice in a vacuum, but investors at the next funding round will not "count" that revenue in their valuation if it's not indicative of a much larger market opportunity later (usually referred to as TAM or Total Addressable Market).

Venture Backed Emerging Tech Ecosystem

Start Up Stage	Year	VC Funding Round	Average Round Size	VC Funding Sources	Key Funding Milestone	Customer Role	DOD Role	DOD Innovation Units
Early	0	Angel Seed	25K 1.8M	Local	Identify MVP/Build Team	Intros - MVP Feedback, Alpha Product Contracts	Attract & Inspire Dual Use Founders	AFC, AFWERX, MD5, NSA2, H4D
Mid		A B	7M 15M	Regional	Launch Product/Biz Model	Engagement - Proof of Concept, Beta Product Contracts	Help Attract Capital, Guide thru DOD "Market"	??? DOD needs to fill this gap.
Late	7	C D Exit	26M 44M 243M	Sand Hill Road/Wall Street	Scale Business towards Exit	Revenue - Long Term Full Production Contracts	Rapidly Deploy Emerging Tech to Warfighter/ Services	DIU

Figure 10. Venture Backed Emerging Tech Ecosystem

Early Stage—Funding Stages and Sources

The Angel and Seed rounds constitute what is called the Early Stage. Note that Early Stage funding data is less reliable than later stage data due to the self-reporting issue. Therefore, this paper is only analyzing A Rounds and later. The Mid and Late Stage sections will start with a review of 2014–2018 dual use funding trends.

Angel Round—On Day 1, when a start-up is first formed through the signing of Articles of Incorporation, it finds financing in one of three ways: either by "bootstrapping" with the help of friends and family, or by securing launch funding from an Angel Investor. Bootstrapping is when the founders use their own money to finance operations. An Angel Investor is a professional venture investor who specializes in investing in a start-up's first round by using outside capital. Angels are almost exclusively high-net-worth individuals, though they often group together in networks. The function of the Angel is to partner with the founders to move them from the "cocktail napkin idea" stage to where they can receive their

first full VC funding round from a traditional Venture Capital Limited Partnership (or the equivalent thereof, like a corporate entity making an early stage minority investment—the nuances are not relevant to the purposes of this paper). Both sources of funding described in this paragraph are usually lumped together under the name Angel Round for convenience.

Seed Round—While usually still pre-revenue, here the start-up usually accepts its first capital investment from a professional venture firm. The importance is that the company has somewhat graduated from the "hobbyist" start-up phase to being serious enough to attract investor attention.

Most major cities have an adequate number of Angel and Seed investors that a founder can get all their financing done locally, as shown by the CB Insights chart in Figure 11. Thus, the DoD does not need a national level function working to organize and attract early stage funding for dual use start-ups. The local innovation units can address that issue organically in their own local venture networks.

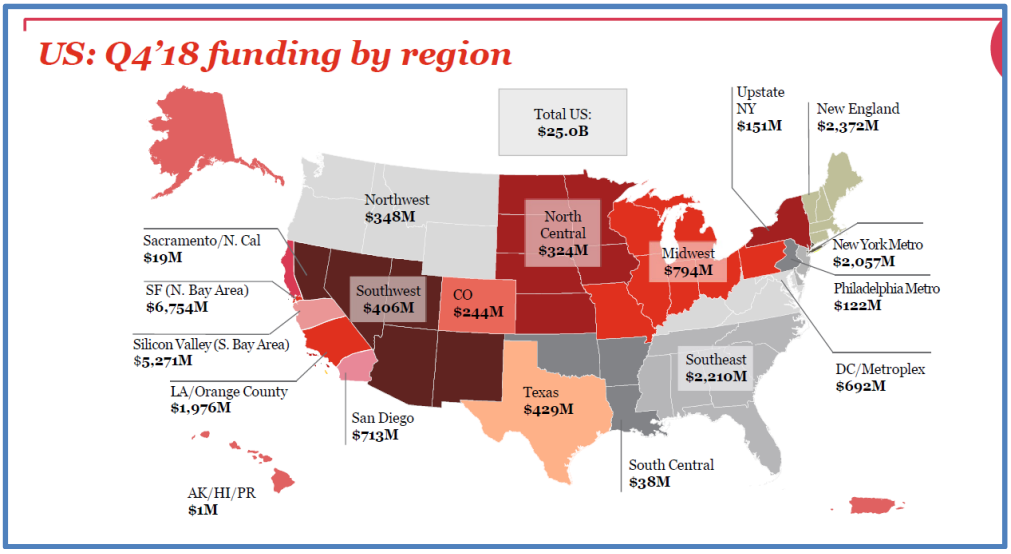

Figure 11. Q4'18 Funding by Region

Early Stage—DoD Innovation Units

The DoD is heavily resourced in its efforts at the Early Stage. A couple of units stand out as notable:

- Hacking4Defense (H4D): According to the H4D website, "Hacking for Defense™ is a university-sponsored class that allows students to develop a deep understanding of the problems and needs of government sponsors in the DOD and IC." The DoD funds H4D, with classes conducted at approximately 20 schools in the fall of 2018 (Johnston, 2018). H4D is an extremely well thought out program (if one endorses the Lean Start Up methodology) for launching dual use founders on Day 1 through Day 90 when the three-month course ends. The formal timeline begs the question of what happens next when a start-up graduates … enter MD5 …
- MD5: Otherwise known as the National Security Technology Accelerator (and rumored around Silicon Valley to be up for a new name and reporting structure

change), the mission of MD5 is to “create new communities of innovators that solve national security problems.” MD5 is well positioned to provide the “Sherpa” function described previously, especially for H4D graduates who need support in their early stage dual use mission from Day 91 through their Seed Round. MD5 is well positioned for three reasons:

1. DoD-Wide: MD5 represents the entire DoD, whereas other early stage outreach units like AFWERX are beholden to a specific service.
2. National Geographic Focus: provides the comprehensive nation-wide network necessary to harness every single state (i.e., and more importantly, every Congressional district)
3. University Focused: a natural hub from which the surrounding innovation ecosystem can be effectively organized, whereas other early stage units lack a consistent geographic home in each geography which leads to inconsistent deployments of resources across regions

- AFC: The Army Futures Command is a vitally important evolution of the DoD innovation outreach strategy. As referenced in the introduction, none of this emerging technology partnering rhetoric matters if it doesn’t end up deployed across the services in the hands of the warfighter. Additionally, the AFC has the largest budget of any services innovation unit at $100 million, a four-star commander, and responsibility for the Army’s entire $30+ billion modernization budget (Freedberg, 2018). However, at least for now, its geographic choice of Austin positions it as an Early Stage player. The southern region, including Texas, Oklahoma, Arkansas, and Louisiana, only account for 6.6% of all venture deals and a meager 2.4% of all venture funding in the United States in 2018, according to the National Venture Capital Association (PitchBook & National Venture Capital Association, 2018).

Early Stage—DoD Goals

In the simple three phase DoD innovation outreach framework described earlier, here is where DoD innovation outreach efforts should be focused on motivating founders to start a company, and/or direct their start-up towards dual use applications. The earlier a start-up embraces the DoD as a customer or security as a market, the more likely it is to develop technologies of interest. This could be thought of as the “battle for hearts and minds in the garages and dorm rooms,” and thus, the Early Stage DoD outreach efforts should be calibrated to this goal.

Mapping the Local Start-Up Ecosystem: In addition to founder-oriented outreach, these Early Stage DoD units need to map out their local/regional innovation. They need to identify all the resources in their assigned region that could support their cause and potentially benefit dual use start-up founders in their company’s first years. Of utmost importance are the Angel Investors described previously and the Angel Networks. All the existing university-based incubators, entrepreneurs clubs, innovation leadership, etc., would also need to be mapped out along with supportive military influence groups such as San Diego’s Military Advisory Council. These are relationship-based networks such that a traditional military rotational assignment model won’t do—another reason that MD5 should serve as the permanent civilian “connective tissue” of the Early Stage.

There a few key efforts here that must be effectively conducted, and somewhat in order:

1. Founding of the dual use start-up—essentially getting from “cocktail napkin” to Articles of Incorporation (Day 1) with Founder’s Equity divvied up among the small number of founders.
2. Incubation (Day 2 through Seed Funding)—Many innovation locales have existing incubators. The DoD should partner there as much as possible. If adequate and effective local incubators don’t exist to serve dual use startups, DoD innovation outreach units may need to start their own. Incubation is where the start-up founders hire employee #1 while beginning the search for their MVP.
3. Customer Intros—The early stage start-up needs as many customer introductions as possible to get input on their MVP. Here the DoD outreach folks can help by providing these introductions to the local DoD units and related agencies. This is probably the single most important function of the DoD outreach units at the early level—to break down barriers between civilian start-ups and local defense entities. Merely getting on base to engage with local military leaders is nearly impossible for civilian founders.
4. Modest Funding—Early Stage start-ups can benefit from small amounts of DoD non-dilutive capital in the form of grants and non-recurring engineering funding. These amounts should probably mirror the practice of commercially-oriented incubators, who often give $50,000–150,000 in funding in exchange for small pieces of equity. The funding helps the start-up get through its first 90–365 days. The DoD money should come with no strings attached and even perhaps no deliverables. The funding is to help the start-up engage with potential DoD customers as the founders search for their MVP. Prototyping comes later and marks the beginning of a multi-year journey from OTA style “no-strings” attached defense contracts towards full rate production Program of Record contracts with full FAR12/15 accounting requirements.

Mid Stage—Funding Trends

As Figures 12–13 show, funding in the Mid Stages appears healthy and growing. The rough total of $9 billion in Mid Stage funding ($4.1 billion A and $4.95 billion B) is encouraging considering how little the DoD has invested in stimulating this funding. As shown later, FY2019 budgets for innovation units focused explicitly on venture backed companies totals less than $2 billion and is arguably closer to a few hundred million depending on how one views the Strategic Capabilities Office (SCO).

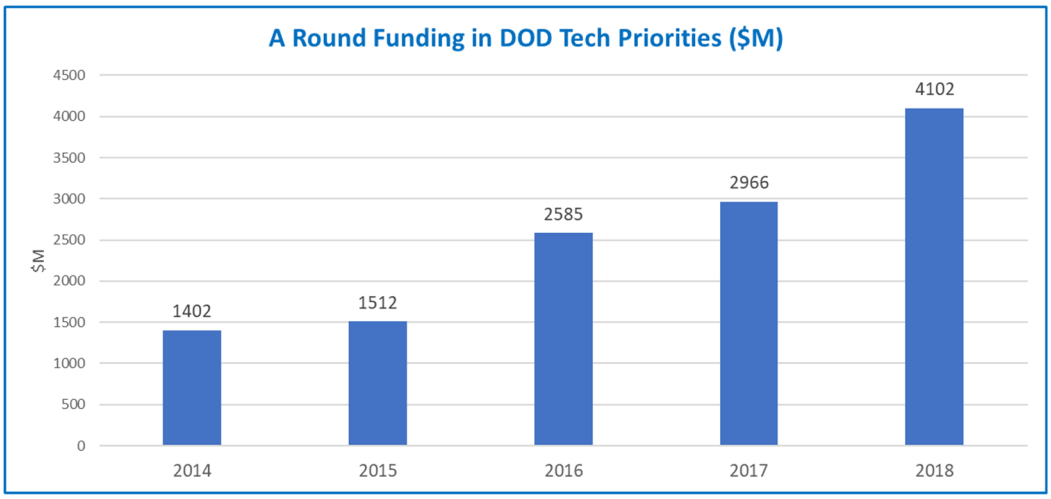

Figure 12. . A Round Funding in DoD Tech Priorities

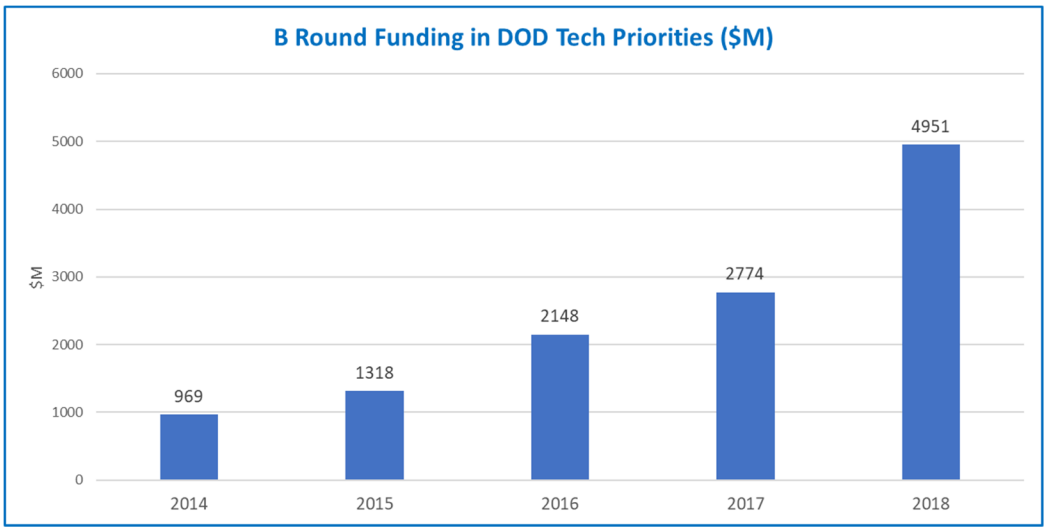

Figure 13. B Round Funding in DoD Tech Priorities

Mid Stage—Funding Stages and Sources

Start-ups crossing the line from the Seed to the A Funding Round also cross the "magical" line from Early Stage to Mid Stage. They are taken much more seriously by professional venture investors. What's important for DoD innovation policy makers is that the sources of funding for Mid Stage dual use begin to narrow and are concentrated more geographically.

A and B Round checks are much larger, averaging $7 million and $15 million in 2018 according to PitchBook. Funding sources capable of writing checks to fit these round sizes are not as readily found in all 50 states. Potential funding partners move from being available locally to mostly being found regionally in the largest cities with the more robust innovation ecosystems. Silicon Valley and the West Coast become more important partners for the DoD and dual use starts ups in the Mid and Late Stages. According to PitchBook's 4Q18 Venture Monitor, the West Coast region funded 61.7% of all VC funding in 2018 (PitchBook, 2019).

This is good news in one sense for the DoD, as it can start focusing its resources geographically towards these funding centers, as the founders will naturally begin building relationships into the networks that can support their next funding rounds.

Mid Stage—DoD Units

There aren't any.

That is a bit of an overstatement, as almost all the DoD innovation outreach units conduct activities that touch the Mid Stage. However, none of them are specifically aimed at this stage with the correct regional focus. The non-defense equivalent here would be an organization like Galvanize with a network of co-location Accelerators deployed in key innovation regional hubs like Denver and San Francisco.

A later section in this paper will survey the majority of the well-known DoD innovation units, where this gap will be more readily addressed. Also, the role of the DIU comes up here. It is based primarily in Silicon Valley with tiny satellite offices in Austin and Boston. So, it would seem natural that it targets the A/B Rounds; which it does. However, as this paper will argue later, the DIU is uniquely positioned to support the DoD in the Late Stage where the checks, stakes, and potential warfighter impact are much greater.

Mid Stage—DoD Goals

The role of DoD innovation units changes as they move into the Mid Stage. Happy hours, free T-shirts, and Sherpa services are no longer as useful to dual use start-ups here. Their Key Funding Milestones require more substantial help if they are going to continue with a defense focus. Beyond customer introductions, they need revenue from early customers not so much to fund their business models, but rather to validate their Minimum Viable Product.

DoD innovation interactions at the Mid Stage, then, should focus on finding DoD customers with priority problems and an agile contracting capability (Other Transaction Authorities being top of that list), and matching them with the most promising dual use start-ups. This is easier said than done. The Federal Acquisition Regulation makes this sort of "customer interfacing" activity extremely difficult for the outreach unit attempting to act as the intermediary. However, the laws of venture funding are as firm as gravity, and they don't care about the need to first issue a Broad Area Announcement and then wait 90 days before undertaking vendor meetings. Those 90 days put the start-up one quarter closer to death (otherwise known as "cash out").

To address the issue raised in the preceding paragraph, the DoD has deployed all sorts of innovation funding experiments, dedicated funds, and related activities. However, no central directory thereof exists. The DoD innovation outreach units need to help solve this discovery problem in their regions. Just as they mapped out the Angel Networks in the Early Stages to better make funding introductions for their incubating dual use start-ups, they must also map out the DoD agile funding ecosystem.

They similarly need to map out the A and B Round funding sources. This should include determining which VCs have accepted Chinese LPs and discouraging dual use founders from taking their money.

Finally, Mid Stage companies are mature enough to take the "on ramp" to a five-year journey from OTA prototyping contracts with minimal paperwork towards PEO full rate/full paperwork prime contracts. The DoD should work to more officially define this "on ramp" approach so that the paperwork requirements match the life stage of the start-up. For instance, an A Round company may be able to support some very modest form of cost

reporting but not a full-blown Defense Contracting Acquisition Agency audit. To that point, professional venture investors rarely ask for fully audited financial statements until the company is nearing its exit, usually with $100+ million in revenue. They would rather the management team focus on growth rather than perfect accounting. The primary financial focus until the exit is on revenue growth, cash burn rate, and cash balance.

Late Stage—Funding Trends

Funding for C Round companies shows nice growth progress, though the level in 2018 is down roughly $1 billion from the $4+ billion in the A and B Rounds (see Figure 14). D Round funding shows a more volatile pattern with strength in the last two years (see Figure 15).

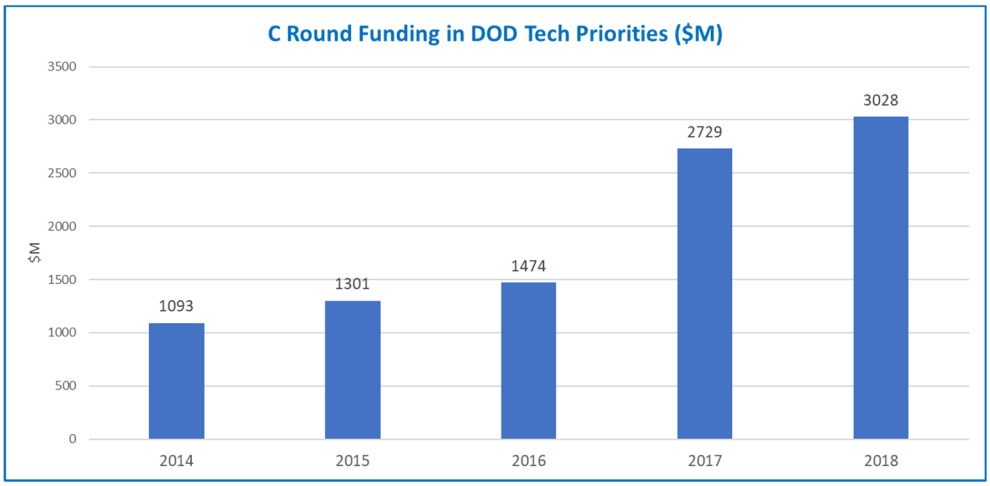

Figure 14. C Round Funding in DoD Tech Priorities

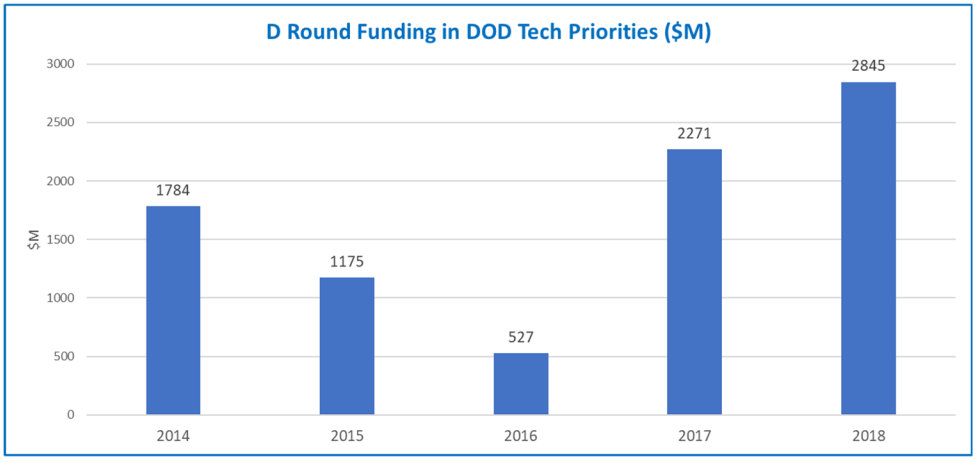

Figure 15. D Round Funding in DoD Tech Priorities

Late Stage—Funding Stages and Sources

Late Stage funding sources become very concentrated. With a few rare exceptions (large family offices, corporates, and sovereign wealth funds), most of the late round equity financing either comes from Sand Hill Road or Wall Street. According to the PitchBook data, 16 of the top 20 most active Late Stage investors in 2018 were based in Silicon Valley.

The average check sizes (total) for C and D Rounds were $26 million and $44 million in 2018. The days of the founder asking his or her parents for some funding are long behind. As pointed out earlier, the West Coast (mostly Silicon Valley) provided 61.7% of 2018 venture financing. However, the region only financed 39.5% of all deals, which speaks to the much larger check sizes.

Late Stage—DoD Units

There should only be one unit focused on the late stage. The DIU is uniquely positioned by geography to manage the Late Stage VC relationships on behalf of the DoD. Venture investing is a relationship-based business. If the DoD wants to attract large checks for its dual use start-up partners, it needs to establish good relationships with those check writers, and those large check writers, like TCV, Andreesen Horowitz, New Enterprise Associates, etc. have more money than time. They and their peers are not interested in meeting every single DoD innovation outreach unit under the sun—AFWERX, CYBERWERX, SOFWERX, DIU, MD5, NavalX, AFC, SCO, REF, and especially those that use a traditional uniformed rotational assignment process.

Second, the PEOs need one authoritative emerging technology partner upon which they can base their long-term acquisition planning. As the PEOs can't integrate dual use start-ups until the Late Stage due to the overhead requirement, that authoritative partner probably should be the same one coordinating the Late Stage VC relationships.

Late Stage—DoD Goals

The Late Stage is where the DoD can finally achieve its ultimate goal of rapidly deploying new emerging technology in the hands of the warfighter at scale. That sounds an awful lot like an official Program of Record.

The early PEO partnerships discussed previously are critical so that by the time the start-ups have scaled enough to afford DoD overhead, the PEOs had their requisite five years lead time to plan to incorporate the start-ups' new technology in their acquisition plans.

Without the PEOs and their Programs of Record, the start-ups lack a big enough customer representing a sufficiently large Total Addressable Market to support an exit and justify their choice of the DoD as a target customer. Thus, the need for an exit drives start-up strategy at every stage. No exit; no VC funding.

Of course, the start-ups can always partner with Traditional Defense Contractors (Primes) and System Integrators (SIs), which they often do and should. However, these partnerships also take extensive time to materialize (and monetize), just as a DoD prime contract would, and the enhanced overhead requirements are still material, even in a sub-contracting role.

Conclusion

The early returns as measured in the dual use funding data described in this paper merit the strong support of National Security Leadership. With all due respect, the opposition to modest funding levels for organizations such as the DIU must stop. The primes and system integrators should instruct their government relations teams to stop opposing these seedling efforts and instead partner with them. Large defense contractors would be better served to fear Amazon's move into their market rather than the DIU. The latter wants to help them; the former wants to dominate them in the digital arms race.

Again, to make the point, China raised more money in one financing round from western investors for its leading AI company than Congress is willing to commit to the

entirety of the DoD innovation units aimed at VC backed companies. Therefore, the early successes described in this paper should not cloud the fact that there is much work still to be done in winning the Digital Arms Race.

To complete the work of supporting the NSIB:

- Congress should fully fund from the appropriations side all the innovation efforts supported from the authorizer side.
- The DoD should deconflict and better coordinate all its innovation units at the OSD level.
- The Services should compel their PEOs to collaborate with the innovation units.
- The Primes should all launch their own venture funds, partner with dual use funds, and make strategically meaningful minority investments into Late Stage dual use companies. They should also increase commercial technology leadership on their boards of directors.
- The System Integrators should facilitate the introduction of emerging technology companies to their customers in partnership rather than continuing to propose building their own (often antiquated upon delivery) custom technology solutions, particularly in software.

True success, finally, will be achieved when venture backed dual use start-up IPOs are commonplace. Only then will the dual-use ecosystem become self-sustaining and the full power of U.S. free markets be brought to bear on this new age of the Great Power Competition.

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