

Department of Defense's Innovation Experiment

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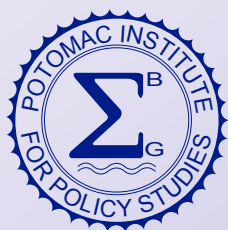
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ARTICLES

FEATURE ARTICLE

Department of Defense's Innovation Experiment

*Robert Hummel, PhD and
Kathryn Schiller Wurster*

“I don’t care to belong to any club that will have me as a member.”

Groucho Marx



The US Department of Defense (DoD) is in the midst of an experiment to inject “innovation” into its procurements and processes. The Defense Innovation Initiative is now in its second year, and has multiple components, but one of its high profile efforts is the Defense Innovation Unit-Experimental (DIUx), which has opened an office in Silicon Valley. The authors contend that the purpose of DIUx is not just to locate and fund interesting companies, but also to educate organizations within the DoD as to the changed culture and funding model that drives innovation in the commercial marketplace. They offer some suggestions for ways that DIUx might operate in the future.

The US DoD believes that the best way to retain, or restore, American technological superiority is through the use of innovation, and they have recently turned to Silicon Valley for help. But when it comes to selecting sources that can help bring innovative technologies and innovative processes into the DoD, it is perhaps best that they select companies that would not want DoD as a client.

In November of 2014, Secretary Chuck Hagel announced a DoD-wide initiative to pursue innovative ways to advance US military superiority, the “Defense Innovation Initiative” (DII). In January of 2015, the Deputy Secretary of Defense Bob Work gave a talk titled “The Third U.S. Offset Strategy and its Implications for Partners and Allies,” and spoke of the need to maintain a technological edge through innovation. Then in April 2015, the new secretary Ash Carter visited Silicon Valley, and in a speech at Stanford University, announced the creation of the DIUx, with an initial office to be stood up in the Silicon Valley area. He stated that the office would “strengthen existing relationships and build new ones, help scout for new technologies, and help function as a local interface for the Department. Down the road, they could help startups find new work to do with DoD.” This is a great concept, but DIUx will need to find and convince companies to accept DoD as a client.

Behind the Defense Innovation Initiative is a worry that the US technological edge is eroding. Bob Work stated that this is “one of the greatest strategic challenges facing the department...that impacts America’s leadership around the globe.” Thus the Third Offset strategy, and the creation of a Defense Innovation Unit, is intended to “sustain and advance America’s military dominance” not only through technology, but also through innovative processes and strategies.

The key is this magic buzzword, “innovation.” It means doing things differently, and not just incrementally improving upon current systems, technologies, and strategies. It implies agility: fast adoption of ideas, and fast transition from the start-up and lab to operational use. And it means taking advantage of ideas generated for the commercial marketplace, to rapidly integrate those capabilities into defense needs. None of these come easy to the DoD.

But what does “innovation” really mean? And how do you create innovation? This is the dilemma that confronts the DoD as they attempt to harness the power of innovation. The Services, such as the Army,

have been conducting “innovation summits,”¹ and have laboratories and directorates intended to find innovative ways to fight and accomplish missions. The Navy has launched the “Navy Innovation Cell” to speed up acquisition of information technology.² The Air Force has opened up its own Silicon Valley office,³ and has an “Airmen powered by innovation” initiative.⁴ Even the White House has “Presidential Innovation Fellows” and a “Strategy for American Innovation.” Clearly, in this new period after the drawdown of major operations in Iraq and Afghanistan, DoD has turned to the notion of “innovation” as a solution, but it is not yet clear how this will be achieved.

For DoD, the challenge is daunting: To use innovation to turn around the erosion in our technological edge and to thereby create military dominance, when adversaries are going to school on developing new and disruptive military capabilities based on observing decades of American operations. The technical areas where the United States is challenged range from ship defense, to air defense, to hypersonics, to electronic warfare, to materials science, to space assets. Analyses of the third offset strategy and the costs of military innovation warn of many challenges, from the vulnerabilities of our potential developments, to financial costs.⁵ How can the DoD create and sustain innovation, when most of its sources in the defense industrial base are those whose business model is to maintain the status quo through updates and refinements?

Ultimately, to innovate, you have to rapidly ingest and accept innovative ideas, and in the case of the DoD, from companies that might not want you as a client. The challenging job of the small and nascent Defense Innovation Unit is to address this dilemma for the DoD.

DIUx CHALLENGES

One aspect of the DII is the creation of the Defense Innovation Unit (experimental), called DIUx. The office was stood up in August, 2015, in Mountain View, California. Since then, the Department has announced an intention to start another DIUx office in the Boston area, and it is expected that another office will open in Austin, Texas sometime later in 2016. Other offices are expected in future years. The combined set of offices will form DIUx, and they can be expected to change course and reboot multiple times as they conduct a large portion of the DoD innovation experiment.

“There are plenty of other mechanisms to learn about technologies – it is the DoD’s acceptance of those innovative technologies and processes that needs to change.”

Each office is intended to be a small point of presence in the respective locale, with a few staff from the Office of the Secretary of Defense (OSD), and a few military or reservists from the Services. Initially, DIUx was structured administratively under the Assistant Secretary of Defense for Research and Engineering, and effectively the Under Secretary for Acquisition, Technology, and Logistics. However, both the Secretary of Defense (SecDef) and the Deputy Secretary have taken an active interest in DIUx-West, and recently restructured DIUx to report directly to a board within the SecDef’s office with a new partnership-style leadership.⁶

The real intention is that the collection of DIUx offices should help give DoD access to innovative technologies and processes. The thinking is there are likely ideas and technologies that are being pursued in small business, or start-ups, or in laboratories in commercial companies, that could have a game-changing impact on national security. In this way, new processes and new systems, both offensive and defensive, might leapfrog capabilities that are being continually incrementally improved. In this sense, the DIUx offices are a means to help find such technology gems.

But in another sense, DIUx is located in innovation hubs in order to give DoD the opportunity to interact with and learn from those companies, entrepreneurs, and investors. The DIUx points of presence are there to influence and change DoD, and not just to provide DoD another way to find potential sources. **There are plenty of other mechanisms to learn about technologies – it is the DoD’s acceptance of those innovative technologies and processes that needs to change.**

DIUx needs to both convince innovative companies to accept DoD as a worthwhile client, and to convince DoD to embrace innovative companies as viable suppliers. DIUx will need to develop relationships between the companies and DoD, by building or restoring existing relationships, and creating opportunities for new relationships. Relationships will go beyond funding and

statements of work. They involve face-to-face interactions, and mutual trust.

THE R&D AND IP MISMATCH

In order to build those relationships, DoD and the representatives from the commercial company’s ecosystem will need to understand one another’s operating models for research and development (R&D) and product development. A major challenge to DoD’s efforts to court commercial companies to increase innovation is that DoD’s R&D funding model does not comport with the culture and valuation of intellectual property (IP) in the commercial marketplace. Whereas DoD pays a company to conduct R&D on their behalf, and expects to own the IP at the end, companies invest in their own R&D using venture capital and expect a big payback from the IP when a company succeeds.

The Ecosystem Model of Innovation Development

It used to be that companies invested in research and development in order to form an internal pipeline that helped reinvigorate the company as time progressed. The pipeline was fed by corporate basic research, which often fed a parent corporation. We can think, for example, of the marvelous inventions of Bell Labs, or the Xerox Palo Alto Research Center, or General Electric Global Research, to name but a few. Historically, these laboratories fed the innovations that the corresponding company used to improve and refresh their product lines.

Today, the way that companies in the commercial sector pursue innovation has completely changed. A large portion of the research and development conducted by companies in recent years works in a much different way than the pipeline approach depicted by a monolithic company investing in research by means of its own corporate research lab. One of the main ways that companies acquire technology innovation is through acquisition of small businesses and other companies whose sole business is to innovate. As a result,

the entire commercial R&D ecosystem has evolved to a much different model of operation.

Basic research into fundamental science remains largely the purview of universities. That has not changed recently, although regulated monopolies such as Bell Labs, many decades ago, enjoyed the luxury of being able to invest in basic research. That has largely gone away. There are some large legacy corporations that still perform basic research, such as IBM, Microsoft, and United Technologies, but their basic research is increasingly on a short leash to development. Newer corporations, such as Google, Amazon, and Facebook have begun to embrace exploratory science, which may represent a new model of basic research.⁷

But on the development side of research, there is now an ecosystem of companies whose aim is to develop

then move to some other start-up. The young programmers and engineers quickly find work elsewhere. For the entrepreneur, a failure or two can be a badge of honor. They have presumably learned from their mistakes.

Over a diversified portfolio, however, the investors are looking for a good return (better than the stock market), fueled by occasional big wins. A win occurs when a larger company buys a start-up, to acquire the IP, to incorporate into its products or business line. They will often stipulate that the people should remain with the company for some period of time, but it is more usual that they are interested in the IP as opposed to the people, since the people (including the entrepreneur) are mobile. A really big win occurs when the purchasing company is one that has a lot of cash and is able to value the IP at a large premium. Google (Alphabet), or

“... the commercial marketplace buys stock in intellectual property, the government purchases the process of R&D.”

innovative products and innovative processes, through experimentation and demonstrations, with the goal of selling or licensing the IP that is acquired. While this ecosystem is not exclusively resident in Silicon Valley, many of the companies in that environs exemplify this type of operation. Often a single entrepreneur with an idea musters a small team of programmers and engineers, and using some funding from an investor, rapidly attempts to build a demonstration of the idea, in order to justify greater investment in subsequent rounds of funding. Then the “start-up” begins to mature into a larger operation, with a more mature cache of IP. The investors, ranging from independent wealthy persons to venture capital firms to established big firms investing for strategic purposes, provide support for the start-up in exchange for a percentage of the IP. Accelerators and incubators also help start-ups, via mentoring and provision of space and facilities, again for a percentage of the eventual sale.

This ecosystem of start-ups and innovators thrives on taking risk. Many of these start-ups fail. The workers

Apple, for example, can generate big wins. The larger companies have big piles of cash available to acquire IP that will lead to quantum leap improvements in their product lines, or new leading-edge products, and thus new revenue streams.

We call this the ecosystem model of innovation development. In the “big wins,” the large corporation is buying the IP; they are not buying R&D, but rather the fruits of R&D. The previous investors were only indirectly supporting the R&D; in reality, they were purchasing shares in the anticipated future IP. They were literally buying stock in the company’s IP. It was the company itself that was “buying” the process of the R&D.

The DoD Model of Innovation Development

In comparison, the DoD invests in companies in a pipeline that migrates from basic research to advanced development and fielding of products. They outsource much of the R&D and eventual production to companies, but they maintain control of the entire pipeline

of processes. In many cases, government laboratories mediate the pipeline. Through this process, the government creates, demonstrates, and owns rights to IP. Over the years, the pipeline became differentiated from commercial companies, as the "Defense Industrial Base" expanded with companies that increasingly serviced the Department exclusively. DoD solicits companies to perform R&D within this pipeline through the well-known process of publishing "Requests for Proposals" or "Broad Agency Announcements." This process assumes innovative companies will come to DoD and are incentivized by the possibility of a contract for performance of R&D. For example, DARPA looks for advanced research from innovative sources, through its projects and solicitations, and thereby funds many small companies throughout the nation, including in Silicon Valley.

This method of procurement, however, assumes the best available sources will be lured to offer their services by the prospect of 6-10% profit on the revenue stream. Many do apply for funding, but it remains difficult for DoD to entice "nontraditional sources" to even consider working on DoD problems. Further, the government typically assumes that all funded work gives the government the rights to use the results for their broad purposes, thus capturing a large portion of the IP, which is a great disincentive for these non-traditional sources.

The result is that even when soliciting innovative solutions, the government receives offers from companies that are in the business of doing work for the government. This greatly limits innovation, because every good proposal writer knows that one should only propose to do precisely what the government reviewer wants and expects. When performing R&D, there are even stronger impediments to taking risks.

Thus, whereas the commercial marketplace buys stock in intellectual property, the government purchases the process of R&D. The government has to perform a lot of due diligence and oversight to ensure that they receive useful results from the bulk of R&D that they purchase, and so they are highly risk-averse. The industry model is to pay for risk upfront by using venture capital, hedging bets by investing widely, and then making money off the IP when they get a big win.

Piles of Cash

Venture capital and large commercial companies have far more cash available, and can spend it far more easily,

than DoD. Innovative companies are therefore much more likely to turn to them than to DoD.

The numbers are murky because much of the cash is overseas, and because corporate investments can include treasuries, bonds, or investments related to the corporate business. But one report has Apple as having \$193 billion in cash and liquid investments, Microsoft with more than \$100 billion, Google with \$67 billion, Pfizer with \$54 billion, and Cisco with \$52 billion.^{8,9} Including energy companies, another estimate has corporate cash holdings at \$1.4 trillion.¹⁰ These holdings generate interest and dividends, and are actually a burden to companies, because the return is unattractive to shareholders, who could get equivalent returns with their own cash. The companies are motivated to spend this money by buying companies that then improve their valuation through their IP. Thus higher valuations are given to companies with innovative IP.

Some companies choose to disburse cash through dividends to shareholders or stock buy-backs. Such tactics are hallmarks of companies that have lost an ability to absorb innovation. The fact that piles of cash have accumulated would suggest that there is a high demand and dearth of supply for innovation, at least in the areas where the existing large commercial corporations operate.

Compare this situation to the DoD. The government does not have piles of cash, although they do have a revenue stream. Agencies such as DARPA, ONR, AFOSR, etc., are able to invest in companies to perform R&D to help the Department innovate. DoD is purchasing the process of R&D. All total, DoD invests around \$13 billion per year in S&T, and around \$70 billion in all R&D.¹¹ DARPA, DoD's innovation generator, spends around \$3 billion per year. However, these numbers include a great deal of spending on management control, oversight, proposal preparation, etc. While companies performing R&D have many of these same expenses, government acquisition of R&D is undoubtedly less efficient.¹²

In any case, the amount of money available for investment by commercial companies vastly exceeds the amounts spent by the government. That does not mean, however, that commercial expenditures on R&D are actually more than DoD's expenditures. The investment models are different. It is the potential for investment by the commercial firms that is interesting, together with the way in which their model permits, and even encourages, risk, in distinction to DoD purchases.

RELUCTANT CONTRACTORS

As a result of the ecosystem model of innovation development, truly innovative companies don't need to turn to the government to support their R&D. Indeed, they often would prefer not, so as to maintain as much of their IP themselves. They have plenty of opportunities for support from investors who seek the big wins. Furthermore, the best innovative companies, and especially the small businesses, are highly motivated to not share their ideas and thinking in public forums, again, so that the IP is not diluted.

Moreover, it is well known that the government is a bad customer. There are regulations, encumbrances, audits, and penalties that can be incurred. Profit levels are limited and meager, compared to the prospects for the "big win." The International Traffic in Arms Regulations (ITAR), which control export of ideas even to foreign persons in the United States, is particularly onerous.¹³ But the greatest impediment is the length of time it typically takes to "get on contract." From the concept phase, presented to a government agency, to the time a project is created and awards are made, several years can pass.¹⁴ For example, the process of conceiving of a new project at DARPA, getting it approved and funded, writing and then issuing a BAA, and then selecting and awarding contracts, will typically take two years. This does not include the time it took for a prospective program manager, who had the idea in the first place, to be hired and come to DARPA. DARPA is considered fast and nimble by DoD standards. But Silicon Valley companies, and small companies in the innovation ecosystem, can come and go in six months. From their standpoint, a delay of two weeks from concept pitch to obligation of funds would be reasonable, but is far, far from possible with current government contracting authorities.

So why should an innovative company bother with the US government? The government, after all, is only one of multiple suitors.

Nonetheless, based on empirical evidence, companies in the ecosystem of innovation development are glad to

talk to the US DoD. In talking, they can explore ideas and potential future markets. The interest expressed by DoD can further bolster investment from the private sector. Department of Defense problems tend to be stressing and interesting, and can lead to greater innovation when examining solutions. Companies are generally supportive of working in the national interest, and are often happy to talk.

Further, companies and investors are happy to receive federal funds, as long as the restrictions that come with those funds are not too onerous. Companies will (usually) gladly accept money to demonstrate their technology, work with other companies in integrating different technologies, and participate in experiments, providing their IP is protected. What they can't endure is the kind of delay that is typical in government contracting. However, "seedlings" such as those used at DARPA based on "Open BAAs" and Small Business Innovation Research (SBIR) projects can sometimes happen in a few months, and these vehicles start to be more viable for small businesses.

Thus it is a myth that the ecosystem companies don't want to work with DoD. They will work with DoD, but they might not want a traditional contract with the usual restrictions. It is more a matter that DoD makes it too difficult, often to the point of being impossible.

WHO'S IN COMPETITION?

The DoD operates on a monopsony model of market dynamics, believing that they, as the buyer, are in the driver's seat, and that the sellers are the supplicants applying for funding. (A monopsony occurs when there is a single principal buyer who can control the market, and thus beat down prices.) DoD is used to dealing with the defense industrial base, a largely captive set of large companies who are accustomed to dealing with DoD's bureaucracy, acquisition rules and culture, and whose primary business is the government.

However, in Silicon Valley, and elsewhere, many of the potential suppliers have other options, as we have

“But the greatest impediment is the length of time it typically takes to ‘get on contract.’”

noted. In this sense, it is the sellers that are in the driver's seat, and the DoD is the supplicant asking for help in achieving innovative solutions.

Of course, both viewpoints are true in certain situations. However, many of the sellers are interested in working with DoD, but are less motivated by funding, and more interested in the problems, interactions, and vetting that DoD provides through their interest in the technology. DIUx will need to educate both the buyers and the sellers. This will be a significant cultural adjustment for DoD, which is used to operating as the buyer with the ability to dictate terms and conditions to a degree that most industries will not tolerate. But these companies – the club that doesn't want DoD as a member – are exactly the ones that DoD needs to learn how to leverage.

DIUx'S REAL MISSION: TEACH DoD HOW TO INNOVATE

The reason the first DIUx office has been opened in Silicon Valley is not to change the ecosystem of the Valley, but rather to give DoD the opportunity to be educated by participants in the Valley about the realities of the marketplace. In many cases, this means informing DoD that they are in competition for the attention of the small businesses and the innovative ideas that are being generated. And that DoD needs to operate on much tighter timelines than their usual acquisition processes afford.

Thus, as DIUx mediates the conversation and interactions between Silicon Valley ecosystem companies and DoD, they will need to make sure that the representatives from DoD understand that they are supplicants for innovative technology. Among other issues, they will need to establish a level of trust that the IP of the companies will not be unduly diluted or shared, even if contracting should occur.

Moreover, DoD believes that they know what is innovative, and the technology trends. It is likely true, because there are many scientists and engineers within DoD who have followed technology trends for many years. But with the pace of change, and the forefront of advanced development in companies, it is also possible that there are hidden gems. You don't know what you don't know: the "unknown unknowns." It will also fall to DIUx to ferret out those, again in an environment of trust with the companies, so that DoD can be assured that they are on top of technology breakthroughs and innovative developments, as they occur.

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Thus DIUx, wherever it is located, is primarily facing the rest of DoD.¹⁵ Its mission is to help DoD understand the marketplace and the competition in which they, DoD, is a participant. DIUx is located in innovation hubs in order to facilitate the gathering of experts who can help explain to DoD these realities, and so that a level of trust can be developed between the companies and DoD. This is not about DoD telling the companies how they can improve their chances of receiving funding from traditional DoD acquisition processes. Instead, it is about letting DoD understand the opportunities that innovation affords them, and exploring ways in which that innovation can be incorporated into DoD systems without disrupting the IP and commercial prospects of these companies. DoD's role is about imagining the use cases of the technology that they discover, and finding ways to enable the integration of that technology without hurting the commercial opportunities or the IP that might apply to non-defense applications.

SO WHAT SHOULD DIUx DO?

The 'x' in DIUx means that it is still an experiment, and DIUx will be experimenting with different kinds of activities in order to fulfill its mission in support

of DoD. As of this writing, DoD has been recalcitrant in receiving the DIUx message, with resulting growing pains and clashes, even among other DoD groups charged with improving innovation.¹⁶ It is the authors' opinion that DIUx is among the Department's most exciting initiatives, with the possibility of making game-changing advancements in our ability to support national security, but that the rest of DoD has not yet accepted the message. We recommend here several possible activities that should take place at the existing DIUx office, and at the offices yet to be opened. In actuality, DIUx has already undertaken examples of each of the activities that we recommend below. Our purpose here is to emphasize some ways in which the challenges that we have outlined above can be addressed by specific actions.

- DIUx should maintain its own database of companies, people, venture capitalists, and experts who participate in the ecosystem model of innovation development. This database will supplement existing compendiums, such as TechCrunch, but will incorporate thoughts by DoD personnel as to possible utility of the resources to national security, such as use cases for developing technology. Some of the use cases might be classified. The database will help DoD to know who is appropriate to invite to forums and exchanges, as described below.
- DIUx should hold forums and technical exchanges on theme topics, inviting government laboratory scientists and representatives from the DoD "Communities of Interest" to meet with relevant technical experts, venture capitalists, CEOs, and corporate developers to explore DoD needs and possible solution spaces. The information flow needs to be two-way, but it is especially incumbent on the DoD participants to not preach, but rather to listen and learn about potential new technologies, and especially about the challenges in leveraging those technologies for DoD purposes. The DoD personnel need to be "prepped" to make sure that the interactions are mutually beneficial.
- DIUx should create spaces where innovators can demonstrate their ideas, and have DoD personnel attend these demonstrations to exchange ideas and come up with potential use cases. In some

cases, DIUx might fund companies to execute a demonstration, or to participate in an integration exercise. In other cases, DIUx might offer a prize for the most relevant or most innovative demonstration.

- DIUx could host symposia, where government personnel can spend informal time with companies and entrepreneurs, to build closer personal relationships and better understanding of the challenges and the opportunities. After certain excesses by some government agencies in holding off-site conferences, the notion of conventions and conferences became problematic in DoD and the rest of government, much to the detriment of government. DIUx offers ideal venues to restart the flow of ideas through symposia-type interactions.
- DIUx should have the contracting authority and funds to make good on the promises of the Secretary and others who have placed such high hopes in DIUx's ability to change the way DoD does business. With such high level backing, DIUx should be able to set an example for how to do contracting quickly and efficiently. Authority to waive provisions of the Federal Acquisition Rules and use of Other Transactions is a start, but probably not enough. All the promises of innovation will be fruitless if DoD is not able to move at the pace that the innovators expect. New tailored contracting authorities and new contracting vehicles will be needed. DIUx should be able to operate and spend funds as quickly as the counterparts at a venture capital firm or large company.

These are among the ideas that might enable DIUx (and other government organizations) to effect change in DoD. Other aspects of the Defense Innovation Initiative might also contribute to this cultural change, and might interoperate with DIUx, such as the DoD's Rapid Reaction Technology Office. The experiment is an important one, and fraught with challenges. However, through greater understanding by both government and business, perhaps we can convert reluctant suitors to become enthusiastic partners in re-establishing our technological edge.



Image credit:
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