DEFENSE INNOVATION BOARD
Open Meeting Minutes
July 12, 2017
1:00 PM to 3:30 PM
Defense Innovation Unit Experimental Headquarters, Mountain View, CA

The Defense Innovation Board (DIB) is a federal advisory committee within the Department of Defense (DoD) operating pursuant to the Federal Advisory Committee Act of 1972, the Government in Sunshine Act of 1976, and other appropriate federal regulations. The DIB meets quarterly and held its fourth public session on July 12, 2017 from 1:00 PM to 3:30 PM in the auditorium of Defense Innovation Unit Experimental (DIUx) Headquarters at Moffett Field, Mountain View, CA.

DIB Members (voting)(8)
- Dr. Eric Schmidt (Chair)
- Dr. Adam Grant
- Dr. Richard Murray
- Mr. Walter Isaacson (Telephonically)
- Dr. Eric Lander (Telephonically)
- Dr. J. Michael McQuade
- Mr. Milo Medin
- Ms. Jennifer Pahlka

DIB Ex-Officios (non-voting)(0)

DIB Staff Support (non-voting)(5)
- Mr. Joshua Marcuse, Executive Director
- Mr. Michael Gable, Alternate Designated Federal Officer
- Maj Kaly McKenna, USAF
- Mr. Nicolas Lopez
- Mr. Aaron Schumacher

Guest Presenters (2)
- Mr. Raj Shah, Managing Partner, Defense Innovation Unit Experimental (DIUx)
- Lt Col Enrique Oti, USAF, DIUx

Public Session Attendees (113)

Livestream Participants (52)

Public Commenters (16)
- Mr. Rob Mee
- Mr. James Cross
- LT Jason Knudson, USN
- Mr. Tom Kalil
- Ms. Mary Witkowski
- Mr. Kevin O'Brien
- Mr. Andres Lazo
- Mr. Robert Medur
- LCDR Kristen Wheeler, USN
- Mr. Mike Dansky
- Mr. William Teseder
- Ms. Betsy Cooper
- CPT James Long, USA
- Mr. Jim Young
- Mr. Stuart Feldman
- Mr. Glenn Dawson

PUBLIC MEETING SESSION

At 1:00 PM, Mr. Michael Gable, Alternate Designated Federal Officer (ADFO), opened the public session and welcomed the members of the public and those joining over the livestream hosted on the Defense Innovation Unit Experimental (DIUx) Facebook page.

Mr. Joshua Marcuse, Executive Director, introduced the Defense Innovation Board members and explained the agenda for the meeting. He thanked DIUx for hosting the meeting and for all of their support. He then turned the meeting over to the Chair, Dr. Eric Schmidt.

Dr. Schmidt thanked Mr. Marcuse and said that the Board has had a very good time serving the Department since inception. He expressed his gratitude to DIUx for hosting and expressed that DIUx is a natural partner for the Board as they share many of the same viewpoints. Dr. Schmidt expressed that there is clearly a large gap between Silicon Valley thinking and the way decisions and procurements are done in the Department. He continued to say that at the core, the Board's mission is to make recommendations on how to close that gap. He continued to list the places the Board had been previously which included: the Vice Chairman of the Joint Chiefs of Staff, the National Security Agency, U.S. Cyber Command, the Defense Information Systems Agency, the Office of Undersecretary for Defense Policy, the Deputy Chief Management Officer, the Undersecretary for Defense for Intelligence, Cost Assessment and Program Evaluation, Naval Special Warfare Command, Space and Missile Systems Center, the U.S. Marine Corps at Camp Pendleton, the Pentagon Comptroller, the Defense Digital Service, and the Strategic Capabilities Office. He concluded by asking Mr. Raj Shah to discuss DIUx.

Mr. Shah began by saying that DIUx's mission is to accelerate commercial technology and innovation in support of national defense. He continued to explain why their mission is important by providing a brief history of the defense industrial base and its support of national security. Today, however, Mr. Shah said that newer technologies like artificial intelligence, machine learning, low-cost sensors and manufacturing, and autonomy have the potential to improve lives while also may be drivers or contributors to future conflicts. Mr. Shah shared some statistics about the divide between Silicon Valley and government including that in 1965, 75% of all R&D came from Government and today it hovers around 20%. To close this gap, Mr. Shah continued, DIUx aims to make DoD a transparent and reliable partner for private sector companies to solve critical national security problems quickly. He mentioned that efforts had ranged from small satellites to underwater robots and nebulized frozen saline to extend life after combat trauma. Mr. Shah shared that over the past 14 months, DIUx had entered into 37 pilot contracts with young companies, representing $71 million of investment. DIUx suspects that 20% of those projects will continue into production. Lastly, Mr. Shah invited audience members to visit DIUx.mil and review the process and current solicitations.

Dr. Schmidt thanked Mr. Shah and asked Dr. Michael McQuade to introduce the Board's 12th recommendation.

Dr. McQuade began by telling the audience the Board had been working on a 12th recommendation titled "Forge New Approach to Data Collection, Sharing, and Analysis." The

Board had introduced the recommendation in their January 2017 public meeting and discussed it further in their April 2017 public meeting. Dr. McQuade continued to say that the Board's hope was to discuss and vote on it today and began to review the details with the audience. He started by saying that the recommendation is focused on how the Department can quickly bring the power of data across the enterprise. The challenge, he stated, is how to take the vast data that exists in the enterprise and turn it into something that is actionable. Dr. McQuade outlined the three other Board recommendations that were already approved that relate to a large-scale data capability. Recommendation 2, making computer science a core competency, Recommendation 4 catalyzing innovation in machine learning and artificial intelligence, and Recommendation 3 creating a culture of experimentation and innovation. He continued to say that combining these three recommendations with this new, twelfth recommendation would provide the Department the opportunity for learning, experimentation, and innovation. Dr. McQuade proceeded to say that the DoD is nothing if not data rich. The only question is if the data is properly available, curated, protected, and recognized as a resource that will drive future military advantage, which, Dr. McQuade said, is what the new recommendation is all about. He then turned the discussion over to Dr. Richard Murray to review the changes from the last meeting.

Dr. Murray began by expressing gratitude for the feedback given to the subcommittee after the last public deliberation. He said that it was helpful in shaping their thinking about the new recommendation. Overall, he said, the new recommendation is about creating a new paradigm for the way the Department views and treats data. Dr. Murray continued to describe the changes since the previous meeting. First, the subcommittee had focused the recommendation to describe what the core problem is and what the recommendation is trying to solve. Second, they outlined the major differences between the way things are done currently within the Department versus innovative private companies, and outlined a tangible course of action. He concluded by saying he hoped to have discussion today to tease out these ideas.

Dr. Schmidt asked if the core problem is data being in silos, and if so, where does the recommendation address fixing that.

Dr. Murray replied by saying that there are certainly ways within the silos to utilize data better. For cutting cross-silos, he continued, perhaps it would be best to look within a Service where there are silos and try to find ways to connect information together. He used logistics data as an example of such an opportunity. He concluded by saying that combining data across DoD is the ultimate vision.

Mr. Milo Medin added that he sees a tremendous lost opportunity with data that is not being collected. Training data, he continued, is critical for machine learning and artificial intelligence to perform well. He continued to say that every fighter plane or destroyer that returns from a mission or deployment and doesn't provide data it collected represents a loss of capability in machine learning and training that is forever lost. Therefore, he said, it is important to determine what data we prioritize as having the highest utility and create a mechanism that allows data to be extracted from systems without modifying those systems.

Dr. McQuade clarified that though there will be physical implementations to support the recommendation, it does not mean that every piece of data everywhere in the Department will

exist on a single machine somewhere in a vault. He added that the recommendation is very much a virtual construct with the overall objective of making the data available to people who have correct, authorized access.

Dr. Schmidt asked if that requires an implementation as a cloud computing service or if there is an intermediate solution.

Dr. McQuade replied saying he thinks the answer is, "both." Ultimately, he continued, a cloud solution will be required to support a large, coherent structure, but there are many places where data can be accumulated and queried locally, either in a local cloud or physical local storage mechanism. He continued to say that the Department must change from a culture that says data must have a purpose to a culture that says we won't know the purpose of the data until some point in the future.

Dr. Adam Grant added that when he has watched organizations become more data driven, they often privilege data that their user collects which is easy to measure and usually quantitative. Since it is automatically recorded, he said, they lose out on qualitative observations. He then asked the Board what they can recommend so that doesn't happen.

Dr. Murray agreed and gave the example of Special Forces interacting with local people in a region and taking paper notes which contain qualitative insight. This data stays on paper and gets filed away and when new servicemembers rotate in, that qualitative insight is not transferred. With advances in handwriting recognition, he continued, there should be an easy process of turning those notes into digital records.

Ms. Jennifer Pahlka also agreed and provided examples from the Board's travels that uncovered many whiteboards that contained critical data. She continued to say that it is not just notes, but structured data that is not digital, and that the digitization process must be more accessible to all servicemen and women both in and out of the field.

Dr. Schmidt summarized by saying that every piece of data should be stored somewhere no matter what the structure is, because we can always go back and discover the structure and use it in an appropriate way. To be clear, he continued, the Board is discussing this as an organizational recommendation and would encourage the Department to best determine the organizational structure.

At Dr. Schmidt's request, Mr. Marcuse opened the floor to a vote, which passed unanimously.

Dr. Schmidt then transitioned the meeting for updates from specific Board subcommittees.

Dr. Murray introduced the Science and Technology (S&T) subcommittee, which he and Dr. McQuade co-chair. The S&T committee went on two visits in 2017 thus far. The first was to the Air Force Research Laboratory (AFRL) and to Sandia National Laboratories in New Mexico. The second was to the Defense Information Systems Agency (DISA) and U.S Cyber Command (CYBERCOM). At AFRL, the subcommittee visited with the Directed Energy and Space Vehicles Directorate. There, they saw good examples of using a Rapid Capabilities Office as a

means of getting to a program of record and establishing ideas quickly. He continued to say the subcommittee visited Sandia to compare and contrast DoD with the Department of Energy, and they witnessed high degrees of innovation and agility which prompted ideas DoD might be able to implement. At DISA, the Board was impressed with the diversity of network infrastructure that they are required to maintain and realized it is more intensive than industry would expect in a network operation center. At CYBERCOM, the Board was impressed with the capabilities and approach for cyber operations. Though, he said, it could benefit from more abundance in computing, communications, and storage, which is a recurring theme throughout the Department.

Dr. McQuade added that it is increasingly clear how much the conversation the Board just had is important across the enterprise, conversation around data, artificial intelligence, machine learning, and the need for computer science and localized capability to pursue quick innovation. Additionally, he added, there is also fairly common conversation around autonomy for decision-making and where it can intelligently provide added capability within specific mission spaces, and the moral, ethical, and chain of command implications. Dr. McQuade said that he believes these aspects will be important to pursue as part of the S&T subcommittee's investigation.

Mr. Medin directed the conversation towards software and said that across all of the Board's visits, a problem surfaced that the Department seems unable to procure or design software properly. Part of the dynamic, he stated, is that the acquisition system is designed to acquire hardware, and now weapons systems are largely dominated by software. Therefore, the process of how the Department writes requirements and the time frames the process operates in, lags significantly. He posed an example of seeing vacuum tubes (Nixie tubes) onboard a Navy ship used to measure depth that were likely built in the 50's or 60's and are still in active use. The vacuum tubes are paired with a computer system on board that is responsible for maneuvering and controls. This computer system was upgraded from Windows 98 to Windows XP a few months prior to the Boards visit. Mr. Medin's point was that while the hardware was old and it still worked, the Department cannot buy software and retain it for that length of time because it ages badly. Nor can the Department acquire a software system that runs on an obsolete operating system that has known security vulnerabilities. Mr. Medin pointed out that the software acquisition time cycle is four to five years before a software-driven system is put in place, which causes the military to suffer with lack of capability and introduces vulnerability. Mr. Medin concluded by saying that the Board will be advising the Department's National Defense Strategy (NDS) in regards to software acquisition as well as war games to ensure simulations and planning take into account more realistic and comprehensive scenarios with today's technology.

Dr. Schmidt asked Mr. Medin if he truly thinks the software problem is solvable.

Mr. Medin replied that it is absolutely solvable. He continued to outline that the commercial sector suffers with some of the same problems and it will require changes in technology as well as policy and personnel. Most of all, he said, process does not trump competence so the Department needs people in the acquisition process who understand software design and development. Additionally, he added, having access to the source code will enable proper testing and evaluation, as well as penetration testing and security analysis.

Dr. Schmidt transitioned the meeting to the Workplace and Behavior subcommittee.

Dr. Grant introduced the Workplace and Behavior subcommittee by saying that they have been examining issues and opportunities related to people, culture, and human behavior by getting a sense of what cultural barrier opportunities exist. He continued to outline that they had seen similar problems across very different kinds of organizations within the Department that are rooted in issues of human nature and challenges of coordination and collaboration. Dr. Grant posited that the Department must get past the organizational uniqueness bias where people have a knee-jerk reaction to say they can't learn from other kinds of organizations. He continued to say that the Board had also uncovered themes of Justice, Safety, and Control – themes he said are required to build an innovative organization. Dr. Grant outlined three areas the Board will focus on. The first is recruiting, hiring, and training, Science, Technology, Electronics and Mathematics (STEM) talent within the Department. The second is creating a culture of experimentation that also really rewards and values risk taking and rapid learning. The third is improving professional development and education as well as training infrastructure. He then turned the conversation over to Ms. Pahlka to discuss recruiting, hiring, and training STEM talent.

Ms. Pahlka began by saying that it is both policy and personnel that will affect the ability of the Department to have a core of STEM talent internally. She agreed with Mr. Medin's earlier point that the Department needs people making decisions who understand software design in both hiring and acquisition. Ms. Pahlka walked through four main things the subcommittee had been looking at. The first is examining the Defense Officer Personnel Management Act (DOPMA) of 1980, which limits the DoD to one vertical path for rank and authority called the up-and-out system. She continued to say that it makes it incredibly difficult to provide specialization and the opportunity for someone to go deep in a STEM field before getting rotated out. She mentioned an anecdote of a colonel who was making progress on software acquisition and STEM talent but was making a career-ending move by staying in that role. Ms. Pahlka said the Board is exploring different solutions, including recruiting STEM talent for six months to a year from the private sector in a sort of tour-of-duty mentality. This same program, she said, was something the White House did with Presidential Innovation Fellows. She added that the Department must modernize the hiring mechanisms for speed and decrease the barriers to exit or enter government service. The Department must let people come in and leave and provide the value they will provide, similar to the career track for doctors and lawyers.

Dr. Schmidt asked Ms. Pahlka to clarify how much more STEM talent is needed.

Ms. Pahlka responded by first clarifying that there are many self-trained STEM experts and software developers in the Department. They are reading books and picking it up online without having an official training department for software and systems administrations.

Dr. Schmidt asked if there is an analog for the military training doctors and nurses receive with specialized programs.

Ms. Pahlka confirmed that there is no analog.

Dr. Grant expressed that, to him, it is terrifying that someone doing critical national security work, with a skill set that took a year or more to develop, will be rotated out with little to no chance to train the person who replaces them.

To illustrate the point, Dr. Schmidt posed an anecdote where a young officer said he was trained "to the gills" on something involving Russia and cyber warfare but was rotating to something completely unrelated.

Dr. Grant said that movement should be expected and the Department won't be able to keep every single talented engineer for a whole career. However, he thought there are creative ways to solve this including one idea of having public-private partnerships on recruiting. He spoke of a partnership that could offer a two-plus-two program with two years as a DoD engineer and then two years at a tech company. This, he said, would allow people to get experience, serve their country, and advance in their profession. He then transitioned the discussion to the second point, building a culture of experimentation and asked Mr. Walter Isaacson to lead the discussion.

Mr. Isaacson began by saying there needs to be a culture of adapted leadership in the corridors of the Pentagon. He continued to say that all the Board's recommendations are technically feasible, but none will work unless there is a dramatic cultural change that allows for risk-taking, rapid learning, and experimentation. To begin this culture shift, Mr. Isaacson said it needs to begin with a purposeful effort by the most senior leaders of the Department. This, in part, would require leadership to reward successful innovators. Additionally, he continued, a real change in the culture would require bottom-up support. Included in this would be a network for innovators, a best practices innovation toolkit, and new fellowships for innovation and design thinking. Mr. Isaacson also noted that mid-level managers often stifle new ideas so it will be important to select those with higher openness to risk tolerance and tie promotion criteria to experimentation and innovation. He concluded by saying metrics are required to measure the effectiveness of the change in culture including the number of waivers of regulations, changes of policy, speed of actions, and statistics on hiring, retention, and procurement.

Dr. Grant thanked Mr. Isaacson and outlined two types of bureaucracies: enabling bureaucracies and coercive bureaucracies. Coercive bureaucracies, he said, are standard bureaucracies with many rules, full of red tape, and stifle the ability to challenge the way things are done. Enabling bureaucracies, he said, use rules to give people direction and this style is one to emulate within the Department. One example Dr. Grant mentioned was a procurement reform effort led by Mr. Steve Calman. Mr. Calman set a goal for everyone to double their credit card purchases since it sped up the acquisition timelines.

Dr. Schmidt mentioned that he had seen military personnel take nonstandard risks in their career, overcome significant social pressure, and that is why they achieved success. Yet, the culture does not define and delineate that risk-taking as correct behavior. He continued by posing a hypothetical - if the military told young service men and women that if they want to achieve the highest ranks, they would have to take at least five career-ending bets and beat them, then the military might get a different outcome in terms of risk-taking.

Dr. Grant agreed with Dr. Schmidt and mentioned that is similar to how innovative private sector

companies evaluate employees for challenging their boss and boss's boss. He then transitioned the conversation to discuss the third subcommittee topic about improving professional development, education, and training. Dr. Grant began by saying the biggest problem with education and training the Board had identified was that there are not really any experiments on what works. The assumption, he continued, is that the current training delivers the knowledge they need and is evaluated entirely subjectively. There are no evaluations that show the best way to develop leaders who understand technology, and who are open to ideas and suggestions. Dr. Grant provided an anecdote of work he had done previously designing a course for training generals and admirals. He said, instead of delivering one course, he should have delivered four or five different versions and then tracked the impact. He concluded by outlining a few more of the WBC's other thoughts include recommending at least 20% of graduate degrees come out of civilian institutions, bringing innovation and design thinking training, and beginning a doctoral degree in strategy.

Ms. Pahlka spoke briefly about the importance of being highly specific with training and making it relevant and clear as to why certain skills are important for a specific job. She also added that a legal review of the laws and looking further at DOPMA would be necessary.

Dr. Schmidt transitioned the conversation to Dr. Eric Lander.

Dr. Lander began his remarks about what the Board plans to achieve in the year going forward, focusing on two main points. The first he mentioned was the Board's involvement with the National Defense Strategy (NDS) and he invited Mr. Medin to discuss that further.

Mr. Medin said the Board's involvement with the NDS shows the Board's ability to try and drive innovation and compress time cycles in acquisition, strategy, and data. He focused on the important of compressing time because, he said, if you optimize for time you may also optimize for cost.

Mr. Marcuse added that there are key mechanisms and processes that the Department uses to shape strategy. One is defense planning scenarios and the other is war gaming. He continued to say that the Board might inject some of their understanding of technology trends, emerging technology, and the way allies and adversaries may be thinking about technology to make more realistic defense planning scenarios and create war games that would provide the Department leadership the opportunity to partake in the risk and experimentation Dr. Grant discussed earlier. Mr. Marcuse added that the Board hopes to not only contribute information to the National Defense Strategy task force, but to also work with people on the Joint Staff, the schoolhouses, and the strategy and plans staffs at OSD.

Mr. Medin spoke about the impact of machine learning on war gaming, saying that if the Department has simulation structures already in place, war gaming could iterate rapidly and measure success on the battlefield in near real-time.

Dr. McQuade added that within the conversation about strategy, it is important to envision where technology will go and in what timeframes. He said that envisioning process will become much more important than it ever has due to the more rapid development time cycles of technology.

Dr. Schmidt discussed that modeling war games and scenarios between China and the US for the next twenty years would be highly informative to the Department.

Mr. Medin added that often an adversary will counter a new system that the US builds. However, he said, it may be useful to have a fundamentally different way of looking at threats on a capabilities basis. Specifically, looking at the limits of what certain technologies can do and how do those limits impact capabilities strategy.

Dr. Lander moved to his second topic of where the Board will be heading in the next year. He spoke about the notion of creating programs within the Department that resembled a DoD accelerator or incubator. He asked Dr. Grant to elaborate on the thinking and potential directions the Board might pursue to lead to concrete recommendations.

Dr. Grant began by saying the initial thought is to create an environment like Xerox PARC or Bell Labs in its heyday. Instead of looking outwards, he continued, there are plenty of innovators within the Department that can be empowered and provided resources. The goal would be to find those people and give them opportunity and support to be effective.

Dr. Schmidt asked Dr. Grant if these people should be in a separate building or offices, or if they should share offices.

Dr. Grant expressed that he wished there were controlled experiments to answer that question. He said he thinks it is dangerous to build a completely detached and divorced unit from major DoD work, so there needs to be some mechanism for both integrating the group's ideas back in as well as some of the DNA so that the culture starts to spread through the Department.

Dr. Murray transitioned the conversation to what success may look like and, in his eyes, it would be to visit a combatant command and see software developers capable of modifying systems in real time. He continued to elaborate on Dr. Grant's point by saying the United States plays a large role as a systems integrator so being able to rapidly connect different groups of innovators from around the department would increase capabilities tremendously.

Dr. Schmidt added that it would be nice for the Board to have a theory of autonomy and decision making that addressed ownership and responsibility between groups. He continued to say innovation is about speed and lack of clarity only slows things down.

Ms. Pahlka added that there exists a documented called the Digital Services Playbook that the CIO of the White House published a few years ago. One of the points, she said, is to empower one person to make decisions. She said it illustrates Dr. Murray's and Dr. Schmidt's points about autonomy and speed.

Dr. McQuade said, in the context of speed, he is struck by the fact that we're talking about computer science as a key skill that's needed. If five years ago, he continued, we didn't know what that computer science is the skill set we would need today, he wondered how we know what we don't have today that we'll need in five years.

Dr. Grant concurred with Dr. McQuade and said there is a lot of talk on how to manage millennials, yet he thinks the discussion should be around what we can learn from them. He mentioned an anecdote the Board had encountered on one of their trips. They were speaking with a leader about adding virtual reality components into simulations and training and the leader thought it was impossible. Yet, all of the junior people in the room were rolling their eyes knowing the technology existed. Dr. Grant's point was that this was an instance where information was not being educated upwards.

Dr. Schmidt thanked Dr. Lander and transitioned the meeting to the next section.

Mr. Marcuse reviewed a few administrative notes including that the Board is a Federal Advisory Committee and as such, the Board can make recommendations but they do not do implement. Therefore, he continued, the purpose of this briefing is to inform the public what the Secretary and his extended team have done with the recommendations thus far. Mr. Marcuse noted this is very important because the Board is action oriented and wants to make sure the advice they are giving is timely, actionable, and making a difference. He then stated he would focus on five pertinent examples. The first, implementation of Recommendation 1 to establish a Chief Innovation Officer, was reviewed by Secretary Mattis who said he would like to defer to the Deputy Secretary of Defense. Therefore, it would be part of his mandate for organizational reform. In the meantime, Mr. Marcuse continued, there are a number of remarkable examples of people doing the kinds of work the Board had imagined the CIO doing, beyond just merely technology and research and development. One example is a Navy program called Illuminate, which trains sailors and Marines in a three-day design thinking boot camp. Second, Recommendation 4 highlights the issue of cyber security and vulnerability and the Department leadership has shown a great deal of interest in the Board's industry and academic perspectives on these matters. Mr. Marcuse said that the Secretary has asked the Board to offer more detailed and specific recommendations on a couple of these areas.

Mr. Marcuse also highlighted two significant programs related to Recommendation 5, catalyzing innovation in Artificial Intelligence and Machine Learning. He mentioned that the Deputy Secretary has asked the Board to develop a more detailed plan for establishing a DoD center for Artificial Intelligence. Additionally, he mentioned Project Maven which the Deputy Secretary has called the algorithm warfare cross-functional team. Project Maven involves applying Artificial Intelligence to a particular type of critical, sensitive data. Mr. Marcuse said it is an important landmark because it is the largest and most expensive initiative and investment the Department as made to date applying computer vision, and similar technology, to a large and important data set that has very significant operational requirements. While the Board members play an advisory role, some members of the Board's teams are part of the executive steering group that is able to provide ongoing rapid input.

Mr. Marcuse proceeded to mention that, in relation to the Board's recommendations on acquisition innovation, the Joint Requirements Oversight Council (JROC), led by General Selva, is conducting a study into acquisition reform including the process of writing requirements. He also mentioned that the Army is conducting its own review of software acquisition. Lastly, Mr. Marcuse said that the Board has seen each Service examining the changes in data, data science

and data analytics. Specifically, he spoke of projects the Marines and the Air Force are conducting on how to use data science tools to enable decision support. Additionally, the Navy has been the first of the services to call for the establishment of a Chief Data Officer. Mr. Marcuse then introduced Lt Col Enrique Oti, USAF, to provide an implementation update on a project that reflects the Board's beliefs around software development.

Lt Col Oti began by thanking Mr. Marcuse and the Board for the opportunity to speak. Lt Col Oti reviewed the progression of his project, which focuses on software in Air Operation Centers (AOC). Lt Col Oti operates his project as if he were running a startup and received seed funding to create a design of what reimagined AOC software would look like. This plan got support from Air Combat Command who provided additional funding. Towards the end of October, the Defense Innovation Board was in Qatar and saw a white board being used for air tanker planning. Lt Col Oti related Mr. Shah's call to him to present this as an opportunity to tackle.

Lt Col Oti began by understanding the problem and described that every day, the AOC planned an air war for the Middle East. To support those plans, four tanker personnel are responsible for ensuring there is enough gas. To do this, they had been coordinating 40-50 tankers to fuel 250-300 fighter aircraft. The planning process involved coordinating information between Excel and the whiteboard and took between two and four minutes per aircraft route. When the Defense Innovation Board saw this, they were disturbed and there was no way to even calculate the wasted gas to put a monetary figure to highlight the issue. Lt Col Oti tasked six software developers from the Air Force. Three were software engineers for the Air Force and three were only software engineers in their spare time. Between December and March the team was able to create a prototype which shortened the planning time to minutes. Lt Col Oti explained that he speaks with his users daily over Slack, a communications platform, to gain real-time feedback and insight. He then outlined four lessons learned.

First, he mentioned Processes. He mentioned there are a lot of buzzwords between the military and Silicon Valley. The one that mattered the most was "agile." He stressed the importance of embracing and truly conducting work within the agile framework. He also spoke about test-driven development, where one writes tests before writing code so it is ready to go when complete.

Second, he mentioned Platforms. Lt Col Oti said that platforms are what automate pipelines, tests, verifications, security, and deployment. Therefore, he continued, platforms are going to be the magic sauce that allows the military to deploy good software worldwide quickly.

Third, he mentioned Policies. He said there are way too many of them and most of them are wrong. There are policies in place that assume everything has to work the first time, every time which is why years of testing are conducted prior to release. On average, it takes the Department 105 months to deploy software. He continued to say that these policies are written for a world that doesn't exist and sustained by people who don't understand there is another way of doing business.

Fourth, and lastly, he mentioned People. The Air Force has a software development team of approximately 470 people out of a three hundred thousand plus total. Additionally, Lt Col Oti

pointed out that he couldn't hire most of them for his project because they knew older languages, not Java and Javascript. That is why Lt Col Oti partnered with Pivotal Labs, who not only helps build products, but also teaches the team on how to do so. Within 120 days the tanker project launched and the entire project cost around $1.5 million. Lt Col Oti estimates that the project broke even after seven days of use considering each tanker costs about $200,000 to fly and now less flights are being scheduled because the routes are more efficient. He concluded by mentioning their second project, which is a dynamic targeting tool for dropping bombs on targets.

Mr. Marcuse thanked Lt Col Oti for his remarks and transitioned the meeting to public comments.

PUBLIC COMMENTS

Mr. Rob Mee from Pivotal Labs began by saying, in his opinion, the most critical capabilities the Department needs is to be able to build software reliably, predictably, and at speed in order to take advantage of machine learning and artificial intelligence. He said that it is a strategic imperative to take advantage of feeding data to machine learning and AI systems, and that the military needs to cultivate that. He also said that the Air Force needs thousands of more software developers. Mr. Mee also addressed whether or not the military would be able to adapt to agile software development. He said that it requires discipline, structure, and process, which military members are inherently good at. Additionally, the members of the Air Force he got to work with learned very quickly. He concluded by saying that he is incredibly optimistic about the military getting very good at software.

Mr. James Cross with Franklin Templeton said that he is responsible for building their venture platform, looking at investing in dual-use military and commercial technologies. He observed that post 9/11, DoD deployed emerging technology rapidly, using a lot of capital from Wall Street. One of his concerns at the time, was that none of the lessons learned were being captured. Ten years later, he said, we are starting to develop an investment ecosystem to help bring emerging technologies to warfighters at a much faster pace in pseudo-peace time. However, he expressed concern that if conditions deteriorate further, we will need to accelerate this process. He encouraged the Board to consider recommending that someone within the AT&L reorganization be responsible for capturing lessons learned and help shape policies that will attract capital. He also recommended broadening the Defense Industrial Base office. Lastly, he recommended DoD have a larger presence in Silicon Valley and the other innovation hubs.

LT Jason Knudson, USN, reported to DIUx from 7th fleet and worked with the Illuminate team. He addressed the question on whether or not to separate the innovators. He started by saying that being an innovator in the Department is dangerous so having the resources, time, and space to develop an idea is important. By isolating the innovators, you also protect the organization from disruptive risk. He recommended the Board look at building a cadre of people who can

transition ideas from the innovators to the body of the organization. Lastly, he said that the Department should have a deliberate policy of removing old technology, legacy systems, policies, and procedures.

Mr. Tom Kalil said that DoD has a fairly elaborate mechanism for doing autopsies on things that go poorly. However, there are no processes for scaling things up that are working, and understanding why it works. Particularly, he said, on management and leadership. Secondly, he said that the Senate Armed Services Committee has interest in increasing the interaction between DoD and people who are involved in management science.

Ms. Mary Witkowski with Google expressed concern over making changes in the correct order to ensure more good was being done than harm. She alluded to the tanker scheduling app opening up new vulnerabilities and giving source code access to people who may harm it.

Mr. Kevin O'Brien from Orbital Insight stressed the importance of dual-use technologies and how commercial firms can benefit greatly from working with the Government to develop new technology and then transitioning it to the private sector. He also said that recruiting and retaining talent will be difficult and recommended training programs for people who can't afford four-year college degrees.

Mr. Andres Lazo from Stanford spoke about his personal story of being an E5 sergeant and getting a traumatic brain injury from a roadside bomb. He recovered and most recently completed a tour of duty as a GS13 innovation specialist and is now part of a team at Stanford working on a concept called Military Design Thinking. His initial recommendations were to connect the disparate pieces of innovation into a unified network, make the tools of innovation open, accessible, and consistent, and modernize the curriculum of the U.S. service academies, ROTC, and professional education programs. He concluded by stressing the importance of people and culture, embracing risks and ensuring the human element is not lost.

Mr. Robert Medur posted a comment on the Facebook live stream expressing that the main concern for those who support DoD, S&T, and R&D programs are streamlining acquisition and contracting, and introducing innovation management tools and technology to support more agile and efficient development and transition timelines.

LCDR Kristen Wheeler, USN, from the Navy Operations Center mentioned the emergence of organizations like the CNO Rapid Innovation Cell, CRIC, the Defense Entrepreneurs Forum, Illuminate, and the Athena Project. The Athena Project, she expanded, is a shark tank-style pitch event which, since 2013, has been hosted over 30 times in 10 locations. However, she said there is no true connection between these ideas and solutions to the labs and money, so more effort needs to be put into scaling the emergence of all these pockets of innovation.

Mr. Mike Dansky spoke about the redundancy in research and development and how wasteful and inefficient it is to not know where the overlaps exist. He also spoke to the cultural change necessary to adapt the procurement process to align with a more software-centric approach. Lastly, he said that the Other Transactions Authority (OTA) is a fantastic vehicle for accelerating technology forward.

Mr. William Teseder began by discussing the bloat within the military and to address that means addressing the number of general officers. He also recommended the Board submit people they meet for non-tactical awards like the Legion of Merit to actually reward people and draw attention to their innovation efforts. He concluded by questioning how the military can calculate the erosion of capability because there are no metrics like erosion of profit. Finding a way to do this, he said, will help establish a sense of urgency.

Ms. Betsy Cooper, the executive director of the UC Berkeley Center for Long-Term Cyber Security mentioned a cyber workforce incubator that they had proposed in congressional testimony a few months prior. The idea would be to bring together individuals from government and the private sector to work on classified problems for one or two year stints.

CPT James Long, USA, a captain in the 101st, expressed how it is important to create incentives that cross-pollinate information that facilities easy access and rewards innovators.

Mr. Jim Young addressed how to recruit and retain topnotch STEM talent. He told an anecdote of DoD Admiral Grace Hopper, one of the greatest computer scientists of all time, did not pass her physical test. However, someone noticed her talents and brought her in anyway. He recommended we reevaluate the funnel with respect to STEM physical standards.

Mr. Stuart Feldman expressed interest in creating medium to large size FRDC-style entities that could hire Silicon Valley-grade people at market prices and build significant systems.

Mr. Glenn Dawson from Valkyrie Systems Aerospace thanked the Board for their help and urged the Board and the audience to remember the human component and impact of all recommendations.

Dr. Schmidt made closing comments.

END OF PUBLIC SESSION

ADJOURNMENT

Mr. Marcuse, with the concurrence of the ADFO, adjourned the DIB's July 12, 2017 public meeting session at 3:32 PM.

I hereby certify, to the best of my knowledge, the foregoing minutes are accurate and complete.

Eric Schmidt, Ph.D.
Chairman, Defense Innovation Board

PARTICIPANT LIST:

Ashwin Agrawal
Jafer Ahmad
Ibrahim AlSuwaidi
Eric Anderson
Irene Au
Jason Becerra
Mario Bernús Monné
Ernie Bio
Heather Blanchard
Al Bolden
Chris Bollinger
Ori Brafman
Ryan Brown
Hunter Brown
Kevin Busque
Leah Busque
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Amy Carle
Betsy Cooper
James Cross
Dell Dailey Jr
Mike Dansky
Grant Dasher
Glenn Dawson
Sebastien de Halleux
Peter Dicaro
Peter Dixon
Patrick Dossett
Malia DuMont
Robin Farmanfarmaian
Stuart Feldman
Jaime Fitzgibbon
Steven Foster
Chris Fregly
Michael Gable
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Luigge Romanillo
Nadia Roumani
Eric Schmidt
Lauren Schmidt
Aaron Schumacher
Riva Sciuto (Litman)
Raj Shah
Ben Shih
Laura Shores
Pavneet Singh
Sean Singleton
Ashley Snyder
Peter Sorrentino
Johanna Spangenberg-Jones
Maura Sullivan
Chris Taylor
William Teseder
Greg Thornton
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