## Defense Innovation Unit (DIU)

# Annual Report 2018

DEFENSE INNOVATION UNIT

Sillicon Valley | Boston | Austin | Washington D.C.

# *Accelerate.*
# *Transform.*
# *Strengthen.*

*EOD ROV (PO3 Tyler Thompson/U.S. Navy)*

# DIU Annual Report 2018

# From the Director

Since September 2018, I have been honored to serve as the Director of the Defense Innovation Unit (DIU). 2018 brought big changes for DIU, including changes in leadership, organizational structure, and even our name, but DIU continues its commitment to delivering commercial innovation to the Department of Defense (DoD) at commercial speed.

To position ourselves for continued success, we have increasingly focused on ensuring our work has impact, improving experiences and outcomes for individual men and women in uniform in deployed environments all the way up to the DoD enterprise. In 2018 we built up the core tools necessary to generate impact at tactical, operational, and strategic levels. DIU implemented new project selection criteria, streamlined internal processes and developed new ones where gaps existed, and expanded contracting capacity.

DIU plays an important role in achieving DoD's priorities. The 2018 National Defense Strategy acknowledged that the United States has returned to an era of great power competition. In prior eras, the United States maintained a military advantage over its adversaries through strategic investments in technology that, when fielded, resulted in superior capabilities. Throughout the 20th century, DoD harnessed technical resources across the spectrum of American industry, national laboratories, and universities to achieve long-term advantages first in nuclear technology and second in information technology, precision-guided munitions, and stealth.

We have much to learn from our past successes but we are also facing a threat landscape that is both more diverse and variable than ever before. While DoD continues to leverage the resources that yielded military-technical advantages in the past, the global diffusion of commercially-produced, dual-use technologies is altering technology competition and changing the character of war. In order to maintain U.S. military superiority in this environment, DoD is adding new resources to its technology strategy, building a national security innovation base (NSIB) to capture the best the commercial sector, industry, academia, and national labs have to offer.

Against this backdrop, DIU's mission is critical. DIU leverages private sector investment and commercial solutions to deliver advanced capabilities across the joint force. Through flexible contracting authorities, DIU works with companies at the leading edge in artificial intelligence, autonomy, cybersecurity, space, and medicine and human performance to solve the military's challenges on commercial terms and at commercial speeds. We are working alongside our colleagues at the Office of the Under Secretary of Defense for Research and Engineering to strengthen the NSIB.

I am proud to share the successes and changes DIU experienced in 2018 and am confident that we will continue to help DoD leverage commercial technology in 2019 and beyond.

Michael A. Brown
Director, Defense Innovation Unit

# About DIU

The Defense Innovation Unit (DIU) is a Department of Defense (DoD) entity that accelerates the adoption of commercial technology to strengthen national security. DIU partners with Military Departments, Combatant Commands, and component organizations to rapidly prototype and deliver commercial solutions that address military challenges across the joint force. Headquartered in Silicon Valley with additional offices in Boston, MA; Austin, TX; and the Pentagon, DIU accesses leading technology companies across the country on behalf of our DoD partners and lowers barriers to entry into the defense sector.

## The Defense Innovation Unit accelerates the adoption of commercial technology to strengthen national security.

Established in 2015, the DIU mission has grown from its original focus on reinvigorating DoD outreach to commercial innovators. DIU sits at the nexus of commercial technology and national security in an era of resurgent great power competition and rapid, global diffusion of technological advancements. The 2018 National Defense Strategy recognized the need to evolve how DoD guarantees U.S. technological advantage within this threat environment and charged the Department and Congress to build a "healthy and secure national security innovation base [NSIB] that includes both traditional and non-traditional defense partners." Currently, DIU is the only DoD entity exclusively focused on delivering commercial technologies to the warfighter and stimulating new, non-traditional entrants to the NSIB.

### THE DIU MISSION

- Accelerate DoD adoption of commercial technology
- Transform military capacity and capability
- Strengthen the national security innovation base

DIU relies on agile acquisition processes and Other Transaction (OT) authority under 10 U.S.C. 2371b to effectively meet these needs. In 2016, DIU pioneered and launched the Commercial Solutions Opening (CSO) contracting process in partnership with Army Contracting Command - New Jersey. The CSO process is designed to competitively award prototype OT agreements on commercial terms at commercial speeds, focusing on outcomes over requirements and incentivizing new companies to do business with the Department. If a prototype agreement is successfully completed, OT authority allows for a noncompetitive, follow-on production OT agreement. Combined, the CSO process and OT authority enable DIU to test, deliver, and scale advanced commercial solutions to national security problems.

Our work is focused around five technology areas where leading-edge capabilities are essential to 21st century military-technical advantage and are developed by the commercial sector: artificial intelligence (AI), autonomy, cyber, human systems, and space. These technologies are the subject of inter-state competition and are already having an impact on how we fight and gain the upper hand on and off the battlefield. DIU ensures DoD has an acquisition pathway to accelerate adoption of these capabilities and our five portfolios are designed to capitalize on U.S. businesses' growing investment in research and development and venture capital funding of high-tech startups.

## DRIVING INNOVATION ACROSS DIU'S FIVE TECHNOLOGY PORTFOLIOS

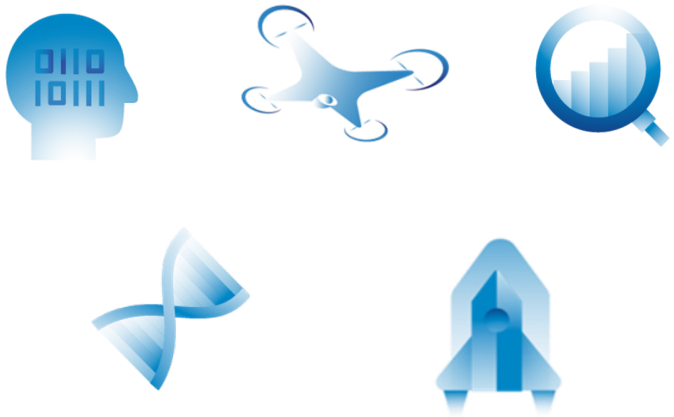
**Artificial Intelligence**
The AI portfolio is focused on understanding, tracking, and vetting commercial AI companies' ability to solve high-impact DoD problems. Recent projects include prototypes to develop algorithms for humanitarian assistance in post-disaster environments and strategic reasoning to deliver insights about force deployment in wargaming and planning environments.

**Autonomy**
The Autonomy portfolio is focused on adopting and countering autonomous systems and rapidly deploying capabilities to meet DoD customers' operational needs. Recent operationally fielded capabilities include multidisciplinary counter-unmanned aerial systems (UAS) employed today both in and outside the continental United States, autonomous quadcopters designed for indoor flight and tactical early warning, software to harden commercial drones against cyber vulnerabilities, and distributed autonomous logistics for long-range delivery of small cargo like medical supplies.

**Cyber**
The Cyber portfolio delivers transformative cybersecurity and enterprise IT solutions that aid cyber warfare operators and analysts projecting cyber power for national security. Recent projects include prototypes that demonstrate endpoint security-as-a-service to enhance information systems' network administration and multi-factor authentication for enterprise security.

**Human Systems**
The Human Systems portfolio aims to enhance warfighter survivability and mission accomplishment through investment in the human platform. Recent prototype projects include augmented reality display technology with night vision capability for enhanced situational awareness in high-threat environments and predictive analytics for early warning of infection and threat agent exposure.

**Space**
The Space portfolio facilitates DoD customers' ability to access and leverage the growing commercial investment in new space to address existing capability gaps, improve situational awareness and decision making, increase interoperability with international partners, and sustain the United States' dominance in space.



# 2018 in Review: A Year of Change

In August, then-Deputy Secretary of Defense Patrick Shanahan reinforced DoD's commitment to DIU and its mission by dropping "experimental" from our name. This path toward permanence is reflected across DIU's 2018 achievements, which prioritized generating greater impact through expanded contracting capacity and new processes that enhance strategic outcomes.

## ORGANIZATIONAL MILESTONES

**FEB** **DIUx Moves to OUSD(R&E): Aligning Objectives**
Then DIUx assumes a new home in the Office of the Under Secretary of Defense for Research and Engineering alongside other DoD entities, such as DARPA, responsible for fostering technological dominance across the U.S. military.

**AUG** **DIUx to DIU: No Longer an Experiment**
DoD leadership removes "experimental" from DIU's original name, signaling our permanence within the Department and underlining the critical role played by commercial technology in strengthening national security.

**SEPT** **DIU Welcomes Michael Brown as Director: New Leadership**
Michael Brown, former Presidential Innovation Fellow and CEO of Symantec, is named Director of DIU. He takes over from CAPT Sean Heritage, who led the organization in an interim capacity following Raj Shah's departure earlier in 2018.

**OCT** **DIU Augments Organizational Structure: Guaranteeing Strategic Outcomes**
DIU established two new outreach teams: the Defense Engagement Team and the Commercial Engagement Team. Together, they are responsible for seeking out high impact projects across DoD and mapping the industry landscape in key technology areas.

**NOV** **DIU Gains Contract Authority: Enhancing Capacity**
The Office of the Under Secretary of Defense for Acquisition and Sustainment grants DIU authority to award OT agreements, allowing DIU to set up internal contracting capabilities for the first time in the organization's history.

**DIU significantly augmented its contracting capacity with the addition of new authorities and government procurement services.** In November 2018, the Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD(A&S)) granted DIU the authority to award OT agreements. Additionally, DIU established a new government procurement service partnership with Washington Headquarters Service - Acquisition Directorate (WHS). Together with DIU's long-standing partnership with Army Contracting Command - New Jersey (ACC-NJ), these added resources expanded DIU's contracting flexibility and capacity. Further, DIU took steps to strengthen and improve the CSO process, used in conjunction with WHS and ACC-NJ to award prototype OT agreements. The DIU team participated in a working group led by OUSD(A&S) to update the Department's OT Guide, released in November 2018, and immediately integrated best practices into CSO procedures.

**DIU established new outreach teams and improved upon project identification, selection, and evaluation processes to enhance capacity and strategic outcomes.** Every DIU project requires a DoD partner, a well-defined problem or need, and appropriate resources to fund and field validated commercial solutions. DIU leadership created the Defense Engagement Team to seek out high-impact DoD projects and new scaling partners and the Commercial Engagement Team to deepen DIU's understanding of the market landscape and its re-lationships in key technology areas. With more proposed projects in the pipeline as a result of these efforts and growing awareness about DIU, we formalized our Project Decision Board to strengthen our project selection and evaluation process. Following rigorous technical and commercial market due diligence, the Project Decision Board leverages frameworks like the Heilmeier Catechism, a set of critical questions developed by DARPA to assess proposed research programs, to select new projects. Furthermore, DIU regularly reviews the cost, schedule, and technical performance data and transition plans of projects currently in execution through new Project Pipeline Review process.

> **"The most important metric for selecting DIU projects is the potential to deliver transformative impact across the joint force.**
>
> -DIU Director, Michael Brown

**DIU implemented a new goal to facilitate at least five projects per year with potential for transformative impact.** While DIU considers a wide variety of criteria when selecting projects, some of the most important indicators of transformative potential include technologies or methodologies that could scale across all of DoD; dramatically reduce loss of life and improve force protection; introduce new efficiencies and save taxpayer dollars in significant numbers; or inspire new operational concepts that enhance military capabilities.

# *Metrics & Performance*

We measure our performance based on our ability to successfully operationalize commercial solutions and deliver them to a DoD customer for transition via production OT agreements or other appropriate contract vehicles. DIU aspires to begin execution of transformative projects; leverage DoD customer funding; operate at commercial speeds; generate DoD savings equal to or greater than ten times DIU's budget; and add new and nontraditional vendors to the NSIB.

**BY THE NUMBERS: JUNE 2016 - DECEMBER 2018**

**104**
Contracts Awarded

**VENDORS**
- 87 Nontraditional Vendors
- 43 First-Time DoD Vendors

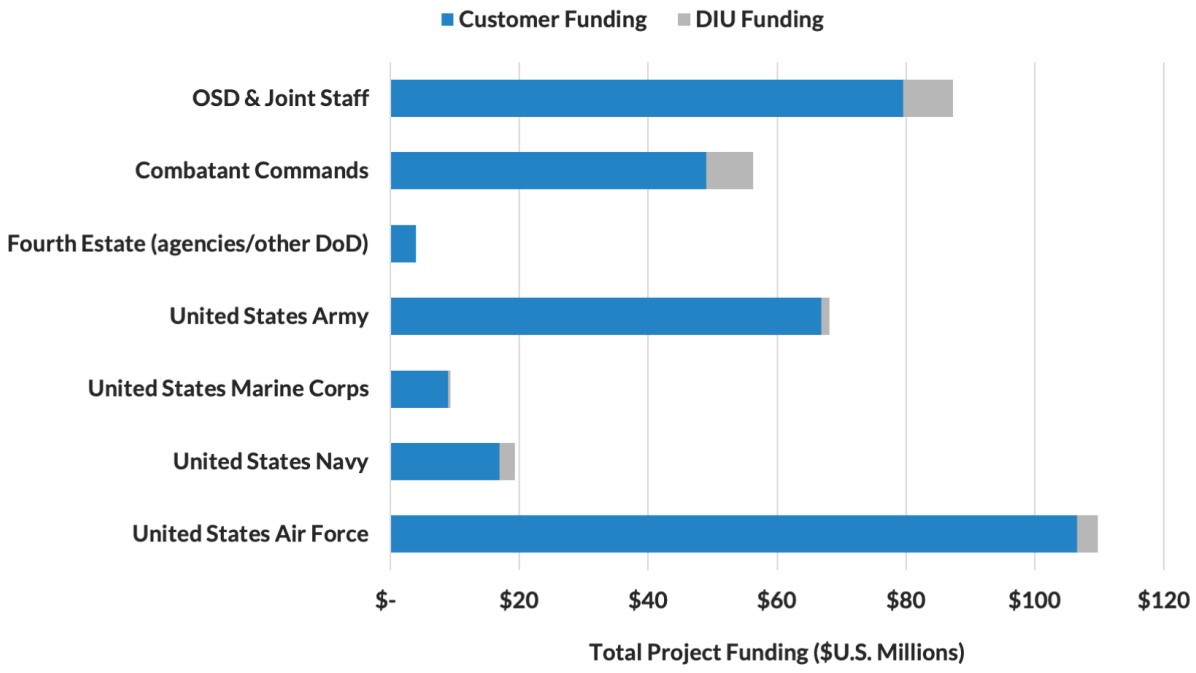
**EXECUTION**
- 05 Transformative Projects
- 43 Completed Projects
- 12 Transitioned Projects

**FUNDING**
- $354M Total Project Award Value
- 94% Project Funding from DoD Customers

**60**
Target Number of Days to Project Award

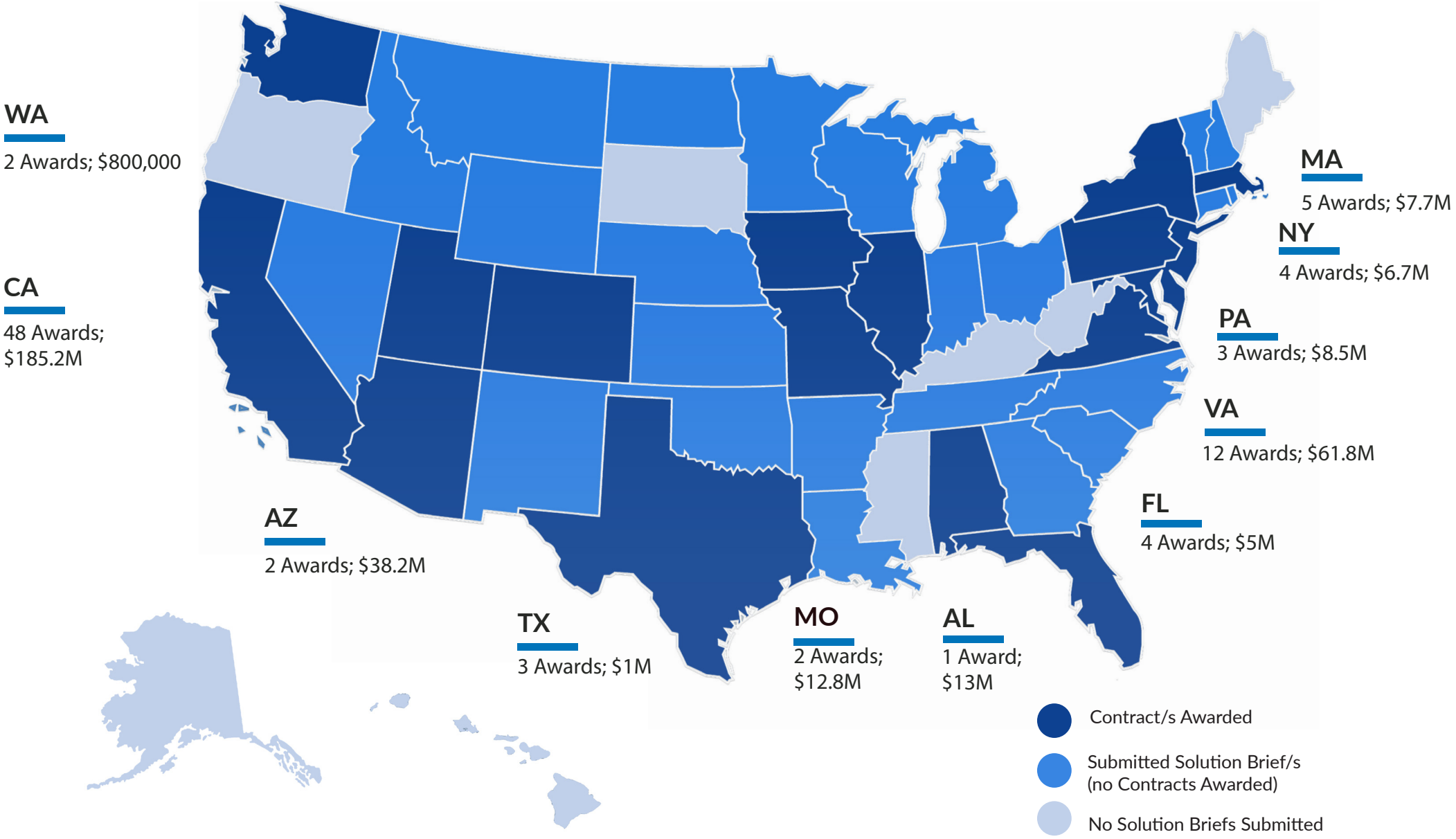
**484**
Average Number of Days in Period of Performance

**PROJECT FUNDING BY CUSTOMER: JUNE 2016 - DECEMBER 2018**



## *Growing the National Security Innovation Base*

As of December 2018, DIU has welcomed submissions from more than 700 companies across 42 states, awarded prototype contracts to more than 90 companies from 18 states, and leveraged more than $4 billion in venture capital.



# Ongoing Transformative Projects

## Predictive Maintenance

*F-35A Lightning II (Staff Sgt. Jensen Stidham/U.S. Air Force)*

DoD annually spends $45 billion to perform time-based maintenance on various aircraft and vehicles and replaces many components well within their working life or ahead of schedule, impacting uptime. To solve this problem, DIU began work on a prototype project to deploy commercially-validated enterprise AI for ingesting, integrating, and applying machine learning to Army, Navy, and Air Force platforms, allowing DoD to move from current time-based maintenance to predictive practices.

Preliminary analysis indicated that AI could predict 28 percent of unscheduled maintenance on the E-3 Sentry across six sub-systems and 32 percent of unscheduled maintenance on the C-5 Galaxy across 10 sub-systems. Due to this initial success, DIU expanded the prototype's scope to apply to the F-16 Fighting Falcon and F-35 Lightning II.

**Potential Transformational Impact**
If the DoD scales and implements this prototype across all aircraft platforms, it could save an estimated $3-5 billion annually in maintenance expenditures.

# Short Range Reconnaissance (SRR)

*Small Unmanned Aerial System (Sgt Rachel Prado/U.S. Marine Corps)*

The U.S. domestic commercial drone industry is under duress, leaving few viable small, tactical drone options for our warfighters. The majority of effective and available drones are of foreign origin and do not meet DoD specific requirements. DIU partnered with the Army's Program Executive Office Aviation to field an inexpensive, rucksack portable, vertical take-off and landing drone that provides the platoon with a rapidly deployed scouting capability to gain situational awareness beyond the next terrain feature.

**Potential Transformational Impact**

The emergence of small UAS has proven tremendously valuable for their operators and have dramatically reduced the time and cost of getting a flying vehicle in the air for a given purpose. If successful, SRR could begin to reinvigorate the U.S. drone industry and provide DoD with trusted and secure sources for commercial small UAS.

# Automated Cyber Vulnerability Detection & Remediation

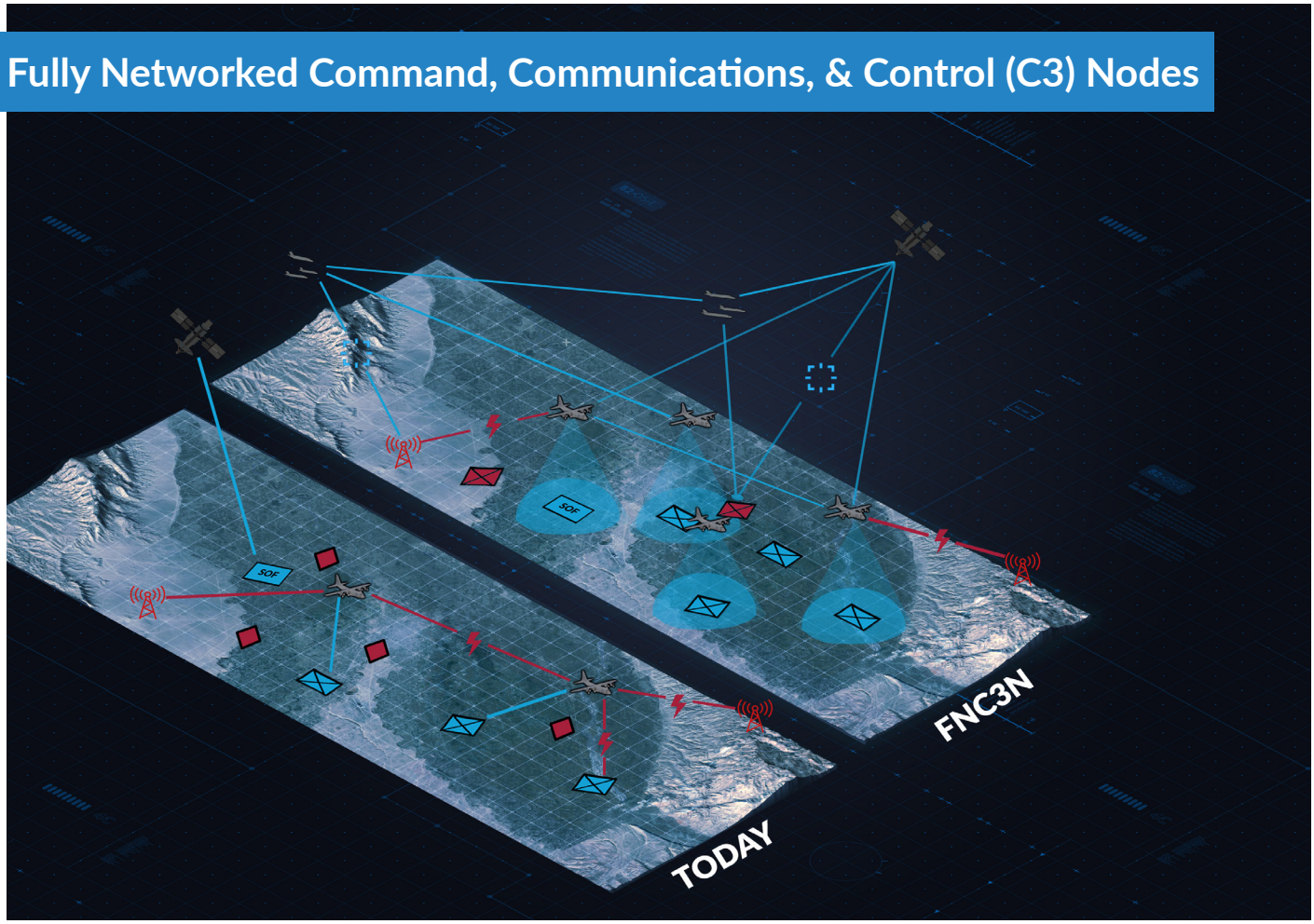

*2016 DARPA Cyber Grand Challenge (DARPA)*

DoD's current process for discovering software vulnerabilities in weapons systems relies on intensive human search and analysis, which is often slow and unreliable. In an October 2018 report, the Government Accountability Office found that unmitigated cyber vulnerabilities put $1.66 trillion worth of weapon system developments at risk. DIU launched project VOLTRON to demonstrate autonomous software vulnerability detection and patching, develop an application programming interface for extensibility, and integrate into DoD software development environments. VOLTRON leverages some of the capabilities demonstrated at the 2016 DARPA Cyber Grand Challenge.

Within the first few minutes of testing the prototype against aircraft software, an initial capability demonstration revealed that previously undiscovered vulnerabilities could potentially allow unauthorized access or disrupt operations. Prototype capabilities have found previously unknown vulnerabilities in currently fielded aircraft systems.

**Potential Transformational Impact**
If DoD integrates these prototypes into DoD's software development and assurance pipelines, it will raise the security of both legacy and future systems.

## Fully Networked Command, Communications, & Control (C3) Nodes




DoD is integrating a larger number of wearables, autonomous vehicles, and space-based assets into the battlefield. However, existing networks are unable to securely connect multiple assets or analyze large quantities of data in real time. DIU's Fully Networked C3 Nodes project FNC3N seeks to implement software-defined, fully-networked C3 nodes to create a resilient, zero-trust, integrated mesh network. Users will have access to real-time data, analysis, and assets. The network will support layered satellite communications, radio frequency, free space optical (laser), high data throughput and speed,  and rapid, continual network authentication.

**Potential Transformational Impact**
This interconnected, tactical network can securely share and process large quantities of sensor data, resiliently operate in denied environments, and enable immediate awareness and isolation of compromised networks. Additionally, the required equipment that communications warfighters must carry will be reduced from tens of pounds to, in some cases, the 5 to 6 ounces that the average smartphone weighs.

# Peacetime Indications & Warning


*Aircraft detection using machine learning algorithms (Orbital Insight) / Commercial Smallsat SAR image of Tanner Point, Norfolk, VA (R2 Space)*

Commanders, warfighters, and first responders require early indications of emergent threats to increase situational awareness, improve decision making, and mitigate risk. A growing number of commercial firms utilize advanced AI and machine learning to convert large volumes of commercial and publicly available satellite images into economic trends and insight analysis. DIU is facilitating the prototype of similar capabilities for the Department by working with commercial satellite firms to rapidly scale low-cost, small satellite constellations to increase temporal resolution for pattern-of-life analysis and anomaly detection.

This project resulted in the first launch of a commercial, small synthetic aperture radar (SAR) satellite into low Earth orbit in January 2018 and a second in December, demonstrating 1x1-m spot imaging of objects in areas of interest. DIU's prototype is demonstrating the viability of small SAR satellite remote sensing-as-a-service with significant cost savings over traditional exquisite capabilities, while scaling to provide 24-hour and all-weather monitoring.

**Potential Transformational Impact**
This approach could fill gaps in space-based reconnaissance, improve revisit rates over areas of interest, and inform requirements for proliferated low Earth orbit small satellite constellations with advanced imagery analytics to improve situational awareness and decision making. Since commercial imagery is unclassified, it provides the basis for combatant commanders to share timely information with allies and partners--something that cannot be easily accomplished with classified imagery collected by national technical means.

# Staffing for Success

DIU's 56 full-time equivalent staff includes active duty military from every Service, Reservists, National Guard, civilians, and contractors who bring extensive military and private sector experience and deep ties into venture capital and startup communities.

DIU has offices in Silicon Valley, Boston, Austin, and the Pentagon. By leveraging the wide range of expertise of our staff in these key regions, we are able to facilitate richer ties with leading edge companies and venture capital firms.





Over 90 percent of our workforce has had military experience at some point in their careers, providing first-hand knowledge of the problems we are solving and familiarity with DoD customers. Additionally, DIU leverages part-time reservists' professional experiences to augment defense and commercial engagement teams by translating DoD requirements for the commercial sector, strengthening commercial outreach, and identifying candidate technologies and companies.

# Looking Ahead

As the threat landscape continues to change and the global economy influences the diffusion of dual-use technology, DIU remains steadfast in its commitment to deliver commercial solutions across the joint force to safeguard our national security. In 2019 and beyond, DIU will continue to accelerate commercial innovation into the hands of the warfighter, strengthen the NSIB, and transform DoD capabilities.

At the direction of OUSD(R&E), DIU will assume operational management of two entities to further consolidate and coordinate DoD efforts to establish new pathways of doing business with the commercial sector and adopt advanced dual-use technology:

- National Security Innovation Network (NSIN), formerly known as MD5-National Security Technology Accelerator; and
- National Security Innovation Capital (NSIC), a new entity authorized by the John S. McCain National Defense Authorization Act for Fiscal Year 2019.

Together, DIU, NSIN, and NSIC will prioritize DoD access to emerging technologies at various stages of technology maturity and create new opportunities for entities within the NSIB to solve national security challenges. NSIN builds and convenes networks of innovators to generate new solutions to national security challenges and offers collaboration and acceleration programs that connect innovators across academia, DoD laboratories, and early stage companies with DoD users. NSIC is a new initiative that will make investments in dual-use hardware and strengthen U.S. supply chains where they are most vulnerable. Consolidating these activities under DIU--and more broadly under OUSD(R&E)--will streamline operations, improve coordination, and strengthen the NSIB.

In 2019, DIU will help launch NSIC operations and establish a single support structure--to include human resources, contracting, finance, operations, and legal--for DIU, NSIN, and NSIC operations to reduce overhead.

www.nsin.us NATIONAL SECURITY INNOVATION NETWORK

### 2019 GOALS

**DIU: Accelerate Adoption of Commercial Technology for National Security**

- Deliver results through five or more transformative projects
- Increase capacity through expanded contracting capability and processes
- Improve budget flexibility to streamline project transition after successful prototypes are completed

**NSIN: Add Talent to the NSIB and Commercialize DoD Lab Technology**

- Work with partners to initiate new dual-use ventures based on DoD lab technology
- Collaborate on at least 100 DoD customer problems through NSIN-led Hacking4Defense and other forums and achieve customer adoption

**NSIC: Fund Potential New Vendors to the NSIB**

- Launch NSIC operations and identify initial investment opportunities in dual-use hardware
- Investing activity dependent on Congressional appropriations for the FY20 defense budget

> **Though DIU will continue to experiment with new ways of delivering capability to the warfighter, the organization itself is no longer an experiment. DIU remains vital to fostering innovation across the Department and transforming the way DoD builds a more lethal force.**

-Deputy Secretary of Defense Patrick Shanahan, August 2018

# WORK WITH US

www.diu.mil