DEFENSE INNOVATION UNIT

ANNUAL REPORT FY 2021

WWW.DIU.MIL

TABLE OF CONTENTS

Astra Space's Rocket 3.3 lifts off from its Alaska launch pad (Brady Kenniston on behalf of Astra Space)

EXECUTIVE SUMMARY

The Defense Innovation Unit (DIU) is a Department of Defense (DoD) organization focused exclusively on accelerating the adoption of commercial technology throughout the Services, Combatant Commands (CCMDs), defense agencies, and other components. DIU partners with organizations across the DoD and the interagency to rapidly prototype, field, and scale commercial solutions that can save lives, lead to new operational concepts, increase efficiencies, and save taxpayer dollars.

In fiscal year (FY) 2021, DIU delivered the following commercial solutions to DoD end-users, bringing the cumulative total of DIU delivered capabilities to 35:

- Commercial Threat Data
- Cyber Asset Inventory Management
- Cyberspace Deception
- Installation Counter-Unmanned Aerial Systems
- Generative Modeling of of Hypersonic Missile Trajectories
- Responsive Launch

In addition to delivering these cutting-edge capabilities to warfighters, we experienced growth across nearly all of our key performance metrics, including efforts to strengthen the national security innovation base (NSIB). Specifically, in FY 2021, we:

- Published 26 solicitations for commercial solutions, a 4% increase from the prior FY.
- Received a total of 1,116 company proposals, a 10% uptick from FY 2020. We saw an average of 43 proposals per solicitation, with the highest number of commercial proposals received in response to a single solicitation rising from 111 in FY 2020 to 153 in FY 2021.
- Issued 72 prototype Other Transaction (OT) contracts to commercial companies, a 31% increase from FY 2020.

DIU also attracts new talent and suppliers for DoD through our National Security Innovation Network (NSIN) and National Security Innovation Capital (NSIC) programs. This year, NSIN expanded DoD's reach as it:

- Integrated 4,566 individuals and 180 early-stage ventures into DoD through NSIN programs and applied project-based work with university partners.
- Adopted 115% of solutions and more than 555 DoD problems.
- Directly supported the launch of 20 dual-use ventures from extant DoD lab technology.
- Added 274 dual-use ventures as a result of DoD partner engagement.
- Helped 370 new companies to enter the NSIB between 2019 and 2021, yielding 33 DoD-funded technologies.

Blue sUAS 2.0 demo at the Air Force Academy in Colorado Springs, CO (Defense Innovation Unit)

- Greatly expanded the regional network team over the last 18 months, including adding 11 new university program directors at designated Tier-1 and Tier-2 research institutions.

NSIC, which addresses the shortfall of trusted private capital for dual-use hardware startups, received its first appropriation from Congress of $15 million. With those funds, NSIC supported nine companies across five domains: autonomy, communications, power, sensors, and space, including products involving microelectronics, quantum phenomena, and hypersonics. These companies' solutions are at various stages of development, from first engineering prototypes to early-stage manufacturing, and are distributed across eight states.

Our achievements this year would not have been possible without our government and private sector partners. Their vision and talent enable us to deliver critical new capabilities to the warfighter.

FISCAL YEAR 2021 IN REVIEW

BRIDGING DOD & COMMERCIAL INTERESTS

We live in an era in which technology competition is the new global battleground. Our adversaries are investing heavily, acting nimbly, and building strategically. Therefore, speed in technology adoption and integration is critical. DIU has reduced the time it takes to identify an urgent problem, prototype a solution, and deploy it to the field, often within two years. We accomplish this through a unique set of processes and tools, including the Commercial Solutions Opening (CSO) and our use of OT authority. These enable us to identify and contract for solutions with greater speed and flexibility, compared with traditional acquisition methods.

Our organization resides within the Office of the Secretary of Defense (OSD), and we attract talent from all of the Services in a mix of active-duty personnel, veterans, reservists, and commercial tech executives. As of September 2021, DIU's staff included 23 civilians, 10 special government employees, 34 active-duty military personnel, 38 part-time reservists, three Intergovernmental Personnel Act staffers, 26 detailees and liaisons, and 77 full- and part-time contractors providing flexible, specialty expertise.

DIU sits at the nexus of defense and commercial tech, providing a unique understanding of both the DoD and commercial landscapes. Our defense and commercial engagement teams enable us to bring the best, most relevant commercial capabilities to meet DoD needs. To further accelerate the adoption of commercial technology, DIU also works with venture capital firms to quickly deliver the best of breed technology to the warfighter.

> **"We're seeing meaningful momentum across the dual-use landscape: larger contract sizes, increased contract velocity and steps toward revenue predictability — all critical milestones for technology companies and venture capitalists. DIU has been an important catalyst in driving this momentum. While there's still significant ground to cover, taking lessons learned from DIU and applying its approach broadly across the DoD acquisition apparatus would certainly enhance our Nation's capabilities and spur further commercial innovation."**
> — Nick Beim, Partner at Venrock Capital

Operators deploying with Banshee Tactical Radios to provide wireless communication in remote areas. (Nokia/Fenix Group)

DRIVING IMPACT

BREADTH OF IMPACT: At DIU, we strive to increase the adoption of commercial technology. In addition to delivering cutting-edge capabilities to the military Services, CCMDs, and DoD agencies, we also serve a number of interagency partners, such as the National Aeronautics and Space Administration, U.S. Customs and Border Patrol, the U.S. Coast Guard, and the Cybersecurity and Infrastructure Security Agency.

DIU also provides thought leadership in the commercial, dual-use technology space. Prime examples of this include our recent *Responsible Artificial Intelligence* and our annual *State of the Space Industrial Base* reports, which provide background and guidance to stakeholders on key issues at the intersection of national security and commercial technology.

> **"DIU is best postured to sustain research and development initiatives that bring commercial space technologies to bear on the needs of national security."**
> — Gen. John W. Raymond, Chief of Space Operations, U.S. Space Force

DEPTH OF IMPACT: DIU seeks to deliver both software and hardware capabilities to the warfighter that are transformative — saving lives, saving money, and saving time. We facilitate integrated deterrence across our six domain-focused portfolios: Artificial Intelligence (AI), Autonomy, Cyber, Energy, Human Systems, and Space. Some of our key achievements from FY 2021 include:

- Our Intelligent Business Automation project reduced the manual correction time for unmatched financial transactions from two hours to two minutes per use case, saving the DoD Comptroller millions of dollars in annual labor costs.
- In August, a team of DIU program managers demonstrated speed when they hand delivered drones to Ramstein Air Base (AB) in Germany in under 24 hours to provide visual supervision as base personnel sheltered Afghan refugees following the collapse of the Afghan government.
- There are currently no fielded sensors that monitor a pilot's physical state in flight. Since 2018, DIU has been prototyping commercial sensors to monitor airflow and blood oxygen levels and to detect life-threatening anomalies, such as sudden incapacitation in flight. In FY 2021, testing expanded to select Air National Guard (ANG) operational units.

EXPANDING ORGANIZATIONAL CAPACITY

ACQUISITION TALENT: DIU is expanding its in-house acquisition team, which leverages OTs to accelerate the adoption of commercial technology within the DoD. To support our ever-growing throughput, we increased the number of DIU agreements officers by 40%, enabling us to manage 46% of new solicitations issued in FY 2021, compared with 28% in FY 2020.

INITIATING NSIC: In February, National Security Innovation Capital (NSIC), the newest component within DIU, received a $15 million appropriation from Congress pursuant to the FY 2019 National Defense Authorization Act. NSIC enables dual-use hardware startups to advance key milestones in product development by addressing the shortfall of private investment from trusted sources.

REGIONAL STRATEGY: DIU announced our fifth office in Chicago, IL, and, with it, a move to a regional focus. Through our regional hub office structure, DIU will leverage our staff, reservists, and our sister innovation organizations—National Security Innovation Network (NSIN), NSIC, AFWERX, Army Applications Lab, and NAVALx—to provide a front door to the DoD which will continue to broaden the NSIB.

MOUNTAIN VIEW, CA

AUSTIN, TX

BOSTON, MA

WASHINGTON, DC

CHICAGO, IL

BEYOND CORE DIU

DIU brings innovation missions together to strengthen the national security innovation base. In addition to our original mission, Pentagon leadership in 2018 directed DIU to assume oversight of NSIN and NSIC, which operate as two distinct DoD organizations with complementary innovation missions. Below are some of their highlights from FY 2021:

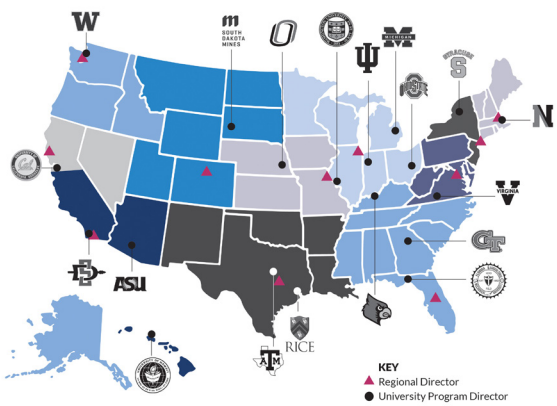
NATIONAL SECURITY INNOVATION NETWORK

MISSION:
Attract new talent to solve national security challenges; leverage start-up and academic communities for concept development; and facilitate the launch of dual-use ventures by commercializing DoD lab technology and customer discovery.

FY 2021 HIGHLIGHTS:

- Integrated **4,566** individuals and **180** early-stage ventures into DoD through NSIN programs and applied project-based work with university partners.
- Adopted **115%** of solutions and more than **555** DoD problems.
- Directly supported the launch of **20** dual-use ventures from extant DoD lab technology.
- Added **274** dual-use ventures as a result of DoD partner engagement.
- Helped **370** new companies to enter the NSIB between 2019 and 2021, yielding **33** DoD-funded technologies.
- Greatly expanded our regional network team over the last **18** months, including adding **11** new university program directors at designated Tier-1 and Tier-2 research institutions.

NSIN REGIONAL NETWORK AND UNIVERSITY PARTNERS

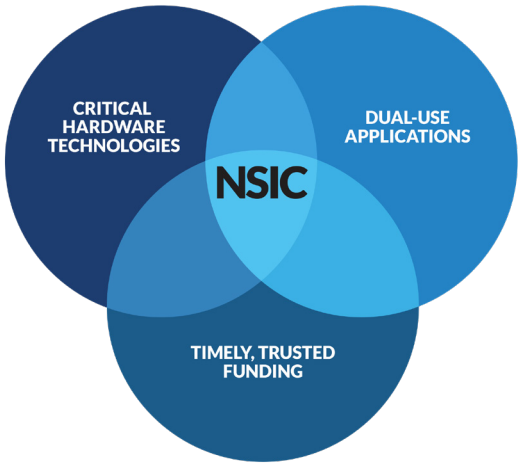


NATIONAL SECURITY INNOVATION CAPITAL

MISSION:
Enable dual-use hardware startups to advance product development catalyzing private investment from trusted sources.

FY 2021 HIGHLIGHTS:

- Obligated **$14.9M** through **nine** contracts (average **$1.75M** per contract) to support the key technology across five domains: autonomy, communications, power, sensors, and space, including products involving microelectronics, quantum phenomena, and hypersonics.
- Helped stimulate follow-on private funding, eliminate adversarial funding, and secure production capacity for DoD use.
- Distributed contracts across **eight** U.S. states (WA, TX, SC, MI, MA, CO, CT, CA).



METRICS & PERFORMANCE

ACCELERATING DOD ADOPTION OF COMMERCIAL TECHNOLOGY

One of DIU's core metrics for assessing impact is the degree to which we are able to operationalize solution prototypes and transition commercial solutions to DoD customers. Over the last six years, DIU has transitioned an average of six technology solutions per year. In FY 2021 alone, DIU delivered a total of eight commercial solutions to DoD end users, bringing our cumulative transition rate to 41%.

FY 2021 Snapshot

26
total number of solicitations published on DIU.mil

1,116
total number of commercial proposals received

43
average number of proposals received per solicitation

72
total number of new prototype OT contracts awarded

8
total number of successful transitions to DoD end users

137
average business days to award

June 2016 — September 2021 At-A-Glance

$892.7M
total value of all contracts made by DIU and DoD partners

$20.1B
in private investment leveraged

119
prototype projects initiated to solve DoD challenges

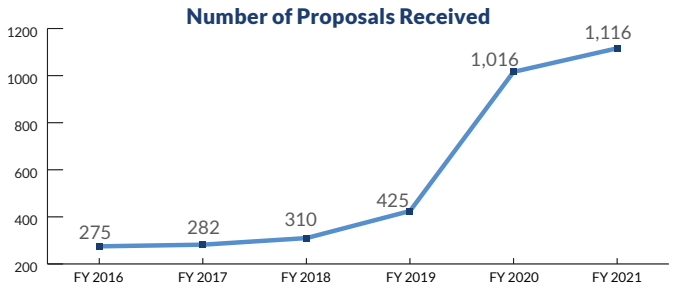
279
prototype OT contracts awarded to commercial companies (CSO only)

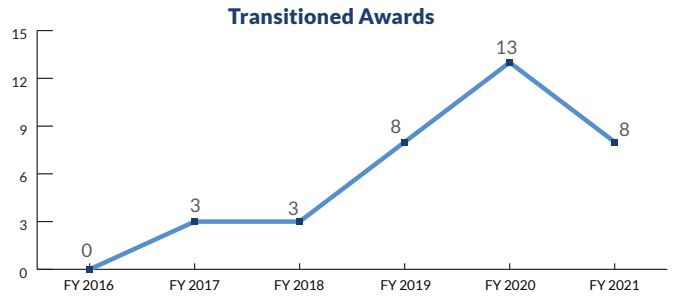
44
projects have been completed (all prototyping efforts concluded)

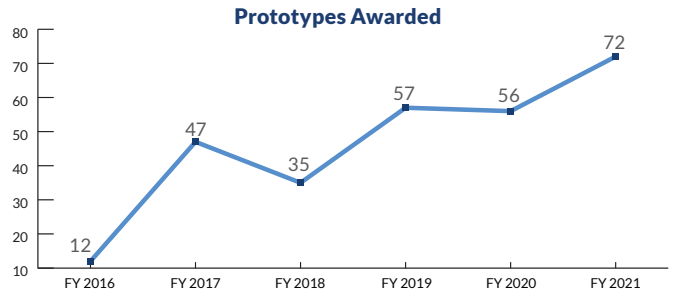
3,424
commercial proposals received

Note: In prior annual reports, we based our metrics and performance on calendar year data. Moving forward, DIU will present metrics and performance on a fiscal year basis. This shift will enable us to better align with DoD and Congressional funding cycles. Additionally, we previously reported the number of days to issue an award to include weekends and holidays. Moving forward, DIU will report on the number of business days to issue an award to more accurately reflect the time it takes to award a contract.

Volume of Activity (Throughput) FY 2016 — FY 2021







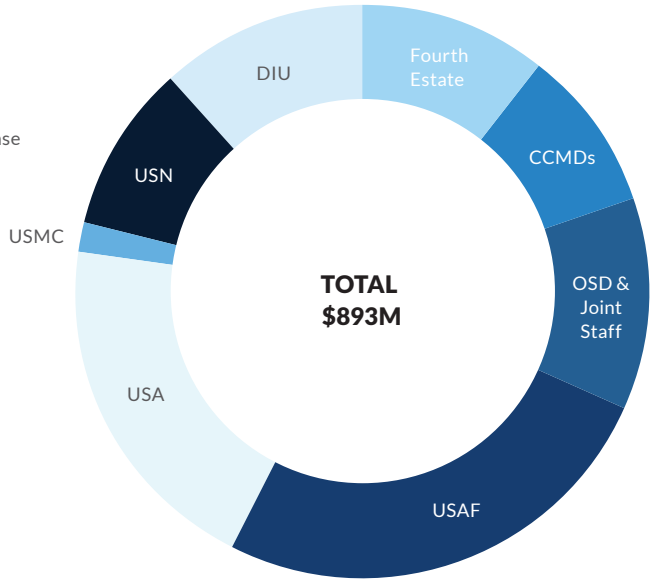
What is a Transition?
A commercial solution transitions when the prototype successfully completes and results in a production or service contract with a DoD or U.S. Government entity. A transition enables DoD to field a product or solution in an operational environment supporting warfighters.

TRANSFORMING MILITARY CAPABILITIES AND CAPACITY

DIU recognizes that widespread technology adoption is necessary to transform military capabilities and capacity. To scale these solutions, we prioritize the projects that can solve DoD-wide challenges.

Obligated Prototype Funding Breakdown by DoD Entity (June 2016 — September 2021)

DIU = Defense Innovation Unit
CCMDs = Combatant Commands
USA = United States Army
USMC = United States Marine Corps
USN = United States Navy
USAF = United States Air Force
OSD = Office of the Secretary of Defense



STRENGTHENING THE NATIONAL SECURITY & ALLIED INNOVATION BASE

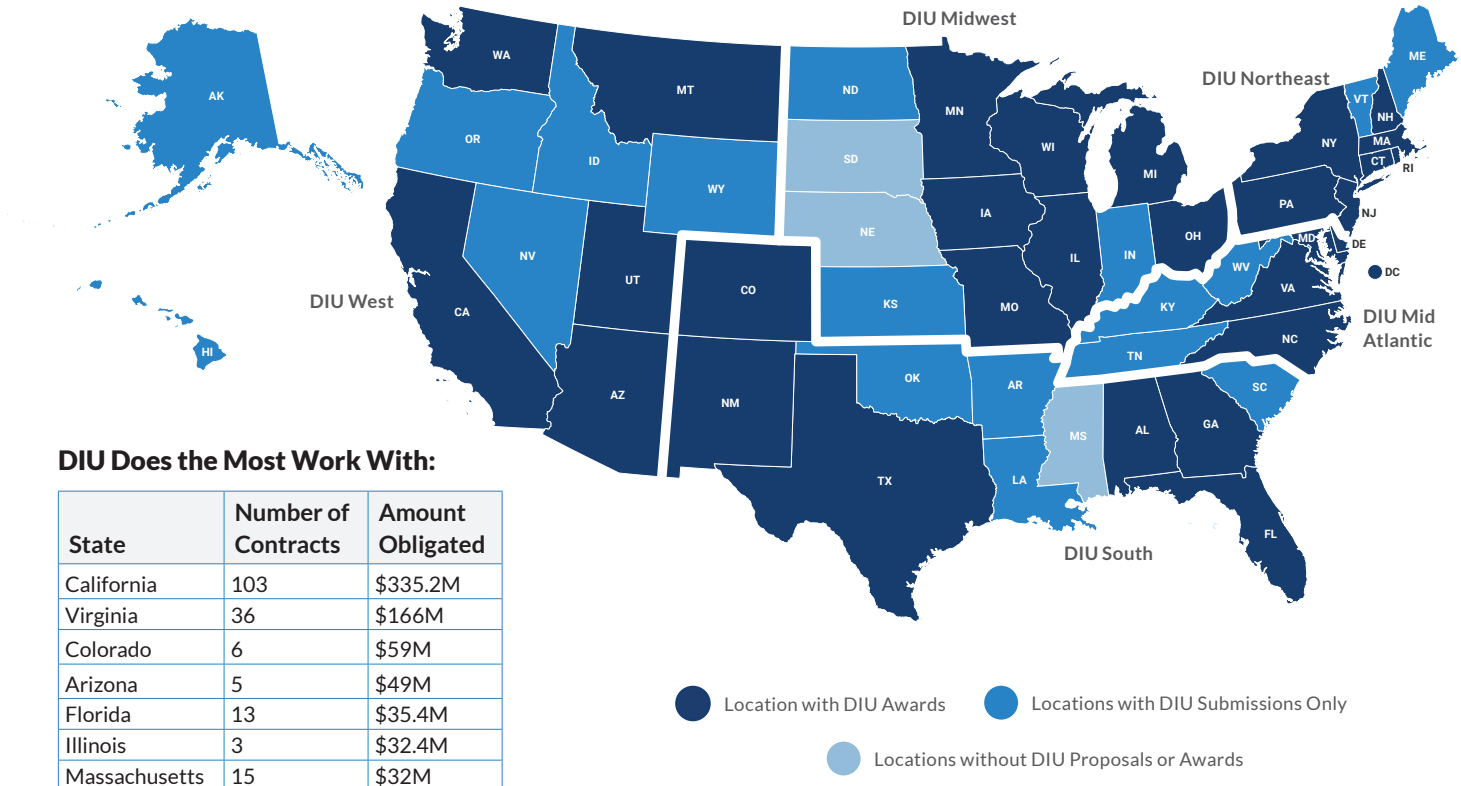
Between June 2016 and September 2021, DIU awarded a total of 279 CSO contracts across 245 unique vendors with a total value of $892.7 million. The top 10 states with the highest concentration of domestic awards were made to companies based in California, Virginia, Colorado, Arizona, Florida, Illinois, Massachusetts, Texas, Pennsylvania, and Alabama. The vast majority (86%) of companies that have received DIU awards are considered nontraditional vendors; 73% are small businesses, and 33% are first-time DoD vendors. The flexibility of the OT authority allows DIU to also work with traditional defense contractors.

DIU will formally open its fifth and newest office in Chicago, IL, in 2022 as part of a broader effort to increase its reach to commercial companies in the Midwest.

"Every year, more tech companies are opening offices in Chicago and enhancing our status as a leading hub for 21st-century innovation … I welcome DIU's expanded presence in the Midwest and look forward to working with them to continue fostering Chicago's strong innovation ecosystem."
—Lori E. Lightfoot, Chicago Mayor

Domestic Awards & Proposals in June 2016 — September 2021 (2371b CSOs Only)

Collaboration with our allies and partners is an area of asymmetric advantage for the U.S., and it is one of the keys to achieving integrated deterrence. Since 2016, DIU has made contract awards to 17 foreign-based companies with a total award value of more than $24.8 million.

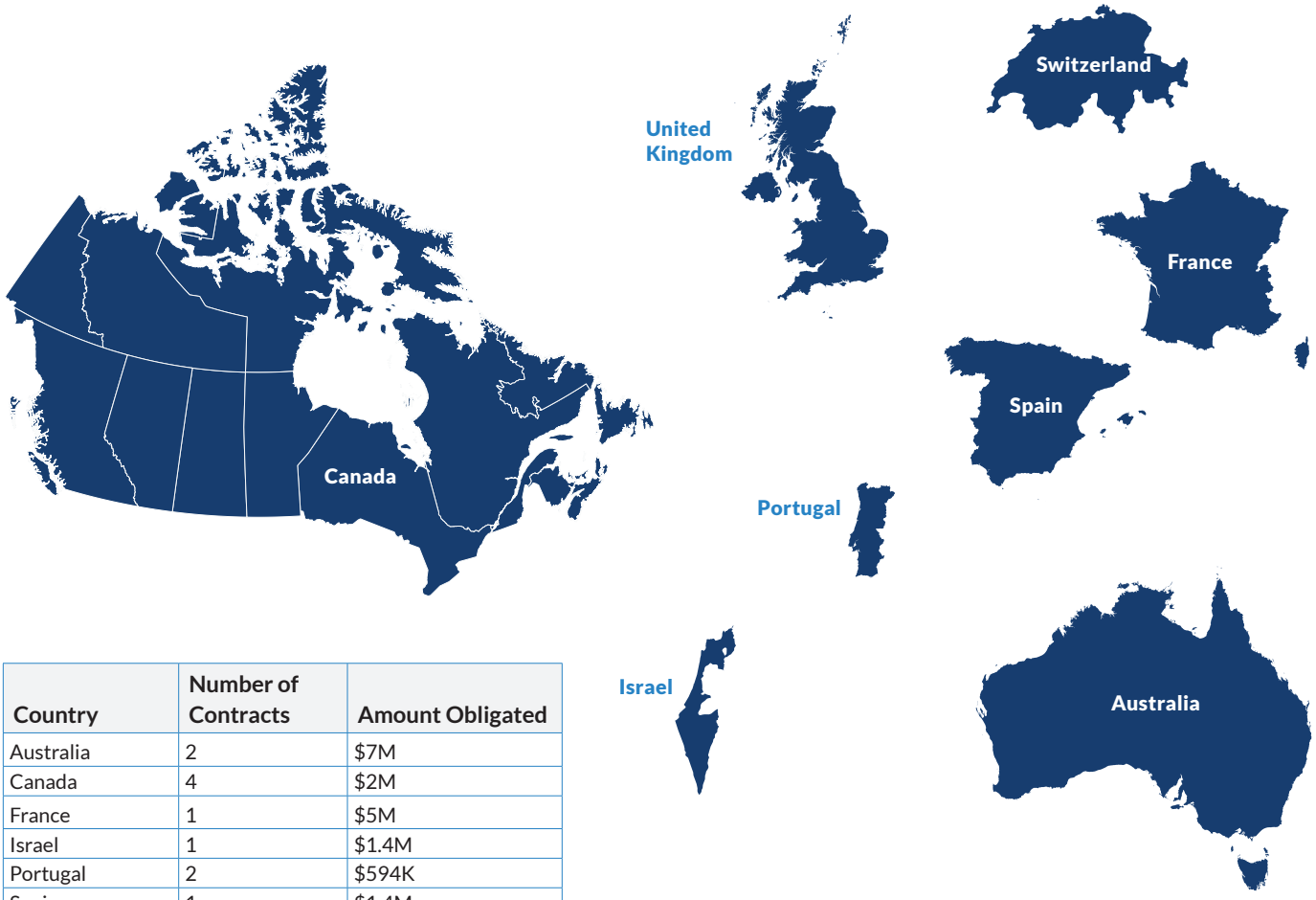


DIU Does the Most Work With:

State	Number of Contracts	Amount Obligated
California	103	$335.2M
Virginia	36	$166M
Colorado	6	$59M
Arizona	5	$49M
Florida	13	$35.4M
Illinois	3	$32.4M
Massachusetts	15	$32M
Texas	15	$29M
Pennsylvania	6	$26M

Note: A first-time DoD vendor has never before worked with the Department of Defense. A nontraditional defense contractor is defined in 10 U.S.C. § 2302(9) as an entity that is not currently performing and has not performed, for at least the one-year period preceding the solicitation of sources by the DoD for the procurement or transaction, any contract or subcontract for the DoD that is subject to full coverage under the cost accounting standards prescribed pursuant to 41 U.S.C. § 1502 and the regulations implementing such section. A small business is defined under Section 3 of the Small Business Act in 15 U.S.C. § 632.

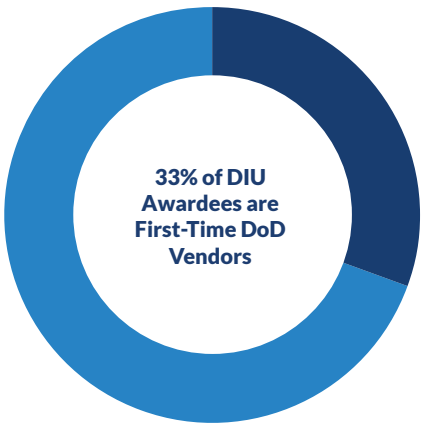
International Awards June 2016 — September 2021 (2371b CSOs Only)[1]

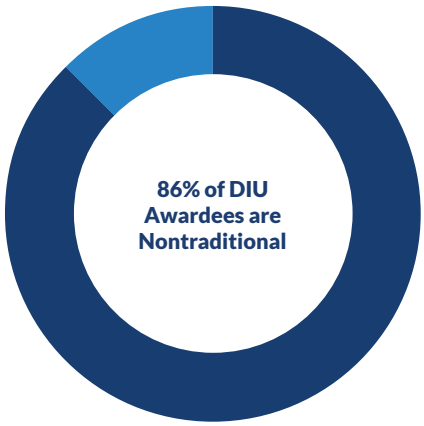


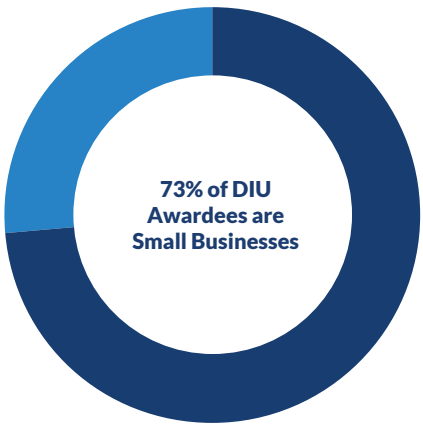
Country	Number of Contracts	Amount Obligated
Australia	2	$7M
Canada	4	$2M
France	1	$5M
Israel	1	$1.4M
Portugal	2	$594K
Spain	1	$1.4M
Switzerland	1	$115K
United Kingdom	5	$7.5M
Grand Total	**17**	**$25M**

[1] Reflects prime contract awards only; does not include subcontractors.

Contract Award Recipients by Business Type in June 2016 — September 2021 (2371b CSOs Only)







FY21 TRANSITIONED PROJECTS

COMMERCIAL THREAT DATA
TRANSITIONED APRIL 26, 2021

Vendor: LookingGlass Cyber Solutions, Inc.
Original Prototype Value: $789.7K
Transition Agreement: Production OT with a $14M ceiling
Transition Partner: U.S. Cyber Command (USCYBERCOM)

DoD lacks insight into the commercial threat intelligence databases that enable real-time analysis and decision-making among cyber operators. LookingGlass Cyber Solutions successfully completed a prototype of its solution for DoD applications and entered into a production OT contract, enabling the DoD and federal government agencies to leverage commercial cyber threat intelligence and analytics. LookingGlass' solution synthesizes global internet data with adversaries' capabilities and motivations to provide a threat modeling environment that speeds up the cyber intelligence cycle and reduces the skill-barrier for advanced cyber analysis.

CYBER ASSET INVENTORY MANAGEMENT
TRANSITIONED SEPTEMBER 29, 2021

Vendor: IntelliPeak Solutions, Inc.
Original Prototype Value: $633K
Transition Agreement: Production OT with a $164M ceiling
Transition Partners: Defense Information Security Agency (DISA), and the Joint Service Provider

Attacks on vulnerable systems can result in costly crashes or denied services. DoD's IT and cyber communities require a comprehensive inventory to reduce corrective patch timelines and to preemptively address network vulnerabilities. IntelliPeak proved the Axonius platform's ability to integrate data from across the DoD enterprise to understand all deployed assets, their current software and firmware, and their configurations. The prototype, run by DIU and DISA, successfully identified large gaps in existing tools. This production contract saved an estimated three years of development time alone for a similar tool as well as over $400k a year for each cybersecurity organization.

CYBERSPACE DECEPTION
TRANSITIONED SEPTEMBER 22, 2021

Vendor: CounterCraft, SL
Original Prototype Value: $679.5K
Transition Agreement: Sole-source Defense Federal Acquisition Regulation Supplement General Services Administration (GSA) contract with a $30M ceiling
Transition Partner: Air Force Life Cycle Management Center and HNCO

Successful cyber operations detect and block threats, leaving little opportunity for military security teams to study adversarial actors or to defend against post-breach actions and hack backs. CounterCraft completed a prototype with DIU, resulting in a sole-source contract with DoD to proactively provide warnings of unauthorized activity and hunt for threats. This cyber deception platform uses sophisticated deception environments to detect and warn against adversarial activity; it has been tested in military wargames with national- and NATO-level red teams.

INSTALLATION COUNTER-UAS
TRANSITIONED JUNE 7, 2021

Vendor: Anduril
Original Prototype Value: $5.1M
Transition Agreement: Production OT five -year contract with a $99.9M ceiling
Transition Partners: U.S. Southern Command, U.S. Marine Corps (USMC), Defense Threat Reduction Agency, Naval Air Systems Command, Customs and Border Patrol (CBP), and U.S. Central Command.

Military-grade commercially-available small unmanned aerial systems (sUAS) pose threats to our Service members when weaponized or deployed for surveillance. Defensive systems must detect, track, and defeat adversarial UAS and distinguish them from friendly systems. Anduril combines the latest in artificial intelligence techniques with sensor technology to enhance physical security through automated detection, identification, and defeat of objects of interest while reducing manpower requirements.

GENERATIVE MODELING OF HYPERSONIC MISSILE TRAJECTORIES
TRANSITIONED MAY 28, 2021

Vendor: C3.ai
Original Prototype Value: $1.28M
Transition Agreement: $2.5M Production OT
Transition Partners: Missile Defense Agency (MDA)

MDA requires accurate and timely models of incoming missile trajectories in order to simulate real-world performance of non-ballistic and hypersonic missiles. Physics-based trajectory models take many months to develop and generate limited numbers of trajectories. In 2021, the MDA awarded C3.ai a production contract after the company successfully completed a prototype with Defense Innovation Unit (DIU) to simulate the real-world trajectories of non-ballistic and hypersonic missiles. MDA will leverage C3's AI tool, which provides a multifaceted development studio for data integration, operations, and security, to expand simulation capabilities for non-ballistic and hypersonic missiles.

RESPONSIVE LAUNCH
MULTIPLE TRANSITIONS SPANNING 2020-2021

Vendors: Rocket Lab USA, VOX Space, and Astra Space
Sum of Original Prototype Values: $27.8M
Transition Agreement: OSP-4 IDIQ with a $968M ceiling (shared among 11 total vendors)
Transition Partner: United States Space Force

Historically, DoD has relied on "rideshares" via large, multi-ton launch vehicles to deploy small satellites. This has limited DoD's access to space due to infrequent launches, which often deposit satellites in less-than-ideal orbits for their mission design. Responsive Launch delivers low-cost, high-cadence, and on-demand commercial launch services capable of precisely launching spacecraft up to 1,200 kg total mass to Low Earth Orbit (LEO). Since the beginning of the Responsive Launch project, DIU has facilitated multiple successful launches delivering spacecraft to mission-designed orbits.

DIU has launched its commercial DIU Product Catalog to provide accelerated delivery of prototyped commercial technology solutions to a broader set of partners across the DoD. To learn more, visit https://diu.mil/solutions/portfolio/productcatalog.

FEATURED PORTFOLIO PROJECTS

ARTIFICIAL INTELLIGENCE

Applying artificial intelligence (AI) and machine learning (ML) to accelerate critical decision-making and operational impact.

FOCUS AREAS

Mission Forecasting and Planning
Leveraging mission-relevant data to predict system failures, anticipate malfunction, and optimize overall performance.

Anomaly Detection
Isolating critical signals from massive datasets to help human analysts focus their limited bandwidth and take effective action.

Complex System Control
Improving the efficiency of complex enterprise systems that manage logistics, manpower, and financial accounting.

Operational Decision Support
Analyzing complex, real-time inputs at scale, allowing operators to make the best decisions in the least time.

AI-BASED KNOWLEDGE GRAPH CONSTRUCTION

Leveraging AI to flag adversary attempts to infiltrate critical national security supply chains three times faster than human analysts.

It is no secret that U.S. adversarial states seek to penetrate and influence the development and production of technology products that are critical to national security. State actors, such as the People's Republic of China, seek access to U.S. supply chains through investments in commercial businesses and financial institutions. Some of these nefarious activities are possible to detect using open sources of information, but early detection, analysis, and response is difficult without advanced AI technology tools that can process massive amounts of information at requisite speed and scale.

In the commercial world, financial firms commonly use AI technology to detect money laundering and other financial supply chain threats. In September 2019, DIU launched an effort to adapt this widely-used commercial AI technology for national security applications. DIU partnered with a leading AI firm that specializes in natural language processing to develop a custom threat detection platform that automates the collection and processing of more than 30 million pieces of open-source information to identify attempts by U.S. adversaries to infiltrate critical national security supply chains.

This AI-based knowledge graph construction capability has enabled DoD to identify, track, and map illicit activities at a speed and scale that is three times faster than what human analysts could perform while maintaining similar levels of accuracy. Armed with this new capability, DoD has already searched and analyzed millions of records and identified dozens of Chinese technology investment firms with illicit operations across the globe. DoD has also been able to expose the networks and methods these firms use to access critical AI technologies. Since applying knowledge graphs to this problem, DoD has learned that many of these firms sought partnerships with U.S. companies while obscuring their real identities to escape U.S. sanctions and restrictions.

xView3 ChallengeUpdate: In July 2021, DIU and Global Fishing Watch, with additional support from the U.S. Coast Guard, the National Oceanic and Atmospheric Administration, and the National Maritime Intelligence-Integration Office, announced the xView3 challenge prize competition to identify the best computer-vision algorithms to identify illegal, unreported, and unregulated fishing companies. Winning algorithms will be announced and deployed operationally in early 2022. To learn more, visit: https://iuu.xview.us/

PREDICTIVE MAINTENANCE

Improving maintenance speeds and driving readiness for the U.S. Air Force (USAF).

DoD coordinates thousands of aircraft and pilots along with tens of thousands of sorties for a broad fleet of aircraft each year, annually spending $45 billion to provide time-based maintenance for various aircraft and vehicles. Additionally, the inability to predict system failure or optimize maintenance protocols

decreases mission readiness and increases costs across aircraft platforms. To solve this issue, DIU conducted a competitive CSO process in July 2017 to identify commercial predictive maintenance solutions. C3.ai was selected, and a two-year prototype effort was launched for E-3 Sentry aircraft maintenance. This prototype entered production in 2019 but has continued to scale and deliver performance improvements for the USAF through the current fiscal year.

In July 2020, DIU partnered with the USAF Rapid Sustainment Office (RSO) to adapt and expand C3.ai's predictive maintenance capability to 22 USAF aircraft platforms. In 2021, the RSO further expanded this capability to the F-35 Lightning II fleet. The team expects to reduce unscheduled F-35 maintenance downtime at rates similar to other aircraft platforms where this technology is actively deployed, increasing mission-capability rates and reducing sustainment costs across the F-35 program.

Prior predictive maintenance contracts for other USAF platforms have saved more than 5,000 hours in troubleshooting time and have yielded mission-capable rates as high as 80%. This predictive maintenance solution has already reduced the time it takes to process vast volumes of F-35 aircraft maintenance information from months to days, and further improvements are expected to save the USAF $5.5 billion once fully implemented across the entire aircraft fleet.

INTELLIGENT BUSINESS AUTOMATION

Helping DoD recover millions of taxpayer dollars in annual labor costs and improving the accuracy of DoD financial accounting.

DoD financial transaction errors take weeks and months to correct, consuming more than 100,000 labor hours in FY 2021 alone. If left unresolved, these errors can lead to billions of dollars in unresolved financial transactions that represent a substantial loss in the control and management of interdepartmental funds. To address this challenge, DIU partnered with Summit2Sea (a technology firm that specializes in intelligent automation) and the DoD Comptroller, to develop a ML solution that can identify and correct unmatched transactions in the Department's enterprise accounting systems.

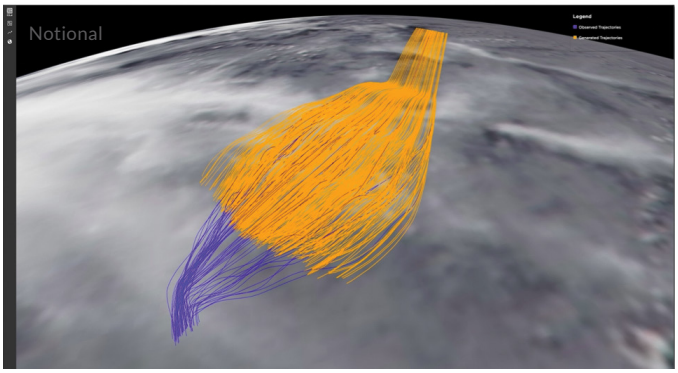
The Comptroller's office deployed the resulting ML solution across six DoD financial management systems, increasing the error detection and correction rate from two hours to two minutes per use case and with approximately 92% accuracy. According to the DoD Comptroller, the solution is saving millions of dollars in annual labor costs that can be redirected to other mission critical tasks while continuing to improve accounting practices.

GENERATIVE MODELING OF HYPERSONIC MISSILE TRAJECTORIES

Harnessing the power of AI to generate synthetic missile trajectories 100 times faster than prior methods.

In August 2021, the Chinese military tested a nuclear-capable missile system launched from a hypersonic glide vehicle that has the ability to change direction during flight. Russia's military is also testing its ability to launch nuclear-capable hypersonic missiles from naval vessels by 2022.

Having anticipated the challenges posed by advances in hypersonic missile technology, DIU partnered with the MDA in July 2020 to improve and accelerate DoD's ability to simulate hypersonic missiles while in flight. This collaboration yielded a new software solution, developed by C3.ai that transitioned to MDA in May 2021.



Notional combination of physics-based and synthetically generated missile trajectories (C3.ai)

The C3.ai solution rapidly generates and analyzes large sets of missile trajectories based on existing physics models in a manner that enables MDA users to consider various operational scenarios. This solution can produce tens of thousands of missile trajectories in a matter of minutes—a 100-fold increase in model generation capacity and speed—enabling the Department to swiftly assess various operational scenarios, as needed, against adversarial missile systems.

AUTONOMY

Adopting and countering autonomous systems with a focus on human-machine interaction and scalable teaming.

FOCUS AREAS

Small UAS
Increasing access to tactical drones, lowering procurement barriers, and supporting the U.S. drone industrial base.

Counter UAS
Delivering defensive systems to detect, track, identify, and defeat adversarial UAS.

Maritime Autonomy
Increasing domain awareness, hazard defeat, and resilient logistics.

Mission Autonomy
Optimizing AI/ML and autonomous learning behaviors, artificial agents, and simulation environments to enable operations in contested battle areas.

Logistics
Streamlining supply chains and reducing human exposure during hazardous logistics operations.

Manufacturing
Producing safer, faster, and more cost-effective construction-scale additive manufacturing and 3D printing capabilities.

Ground Mobility
Advancing commercial autonomous vehicle technology to improve safety systems, fuel economy, increase force protection, and reduce boots on the ground.

BLUE UAS

Rapidly delivering trusted and capable drones, enabling components, autonomy software, and common standards to the warfighter at the point and time of need.

After the Taliban seized control of Kabul and the Afghan government collapsed in August 2021, thousands of Afghani civilians fled the country in search of safety, prompting Operation Allies Refuge (OAR). Within a week, Ramstein AB, a major airlift hub in the U.S. European Command, became a temporary staging point and shelter for evacuees. The sudden and large influx of people engendered an urgent need for aerial surveillance capability on base.

Many military installations are unable to use drones because of airspace restrictions, the threat of cybersecurity vulnerabilities and data collection, and the general difficulty of obtaining authorizations. Lacking sufficient organic resources, leadership at Ramstein AB contacted DIU to procure small, secure drones from DIU's Blue UAS program. Less than 24 hours later, DIU Program Managers were on a plane to Germany with drones in hand.

> **"While we focused on the process, USAFE-AFAFRICA A5/8/9 and the Defense Innovation Unit teamed up to focus on the technology and its application…A589 and DIU were with us every step of the way, ensuring the technology met our requirements, integrated into our processes, and produced results."**
> —Major Neal Lundby, sUAS Installation Program Manager

Drone image of OAR staging area at Ramstein AB, August 2021 (Defense Innovation Unit)

Ramstein AB personnel quickly operationalized four Blue UAS systems in a matter of hours rather than weeks; received drone operation and safety training; and established a live surveillance feed over an active airfield. The actionable intelligence obtained from the drones was integrated into OAR operations and gave Ramstein leadership the situational awareness they needed at a critical point in time for the safety of their guests and all operations.

Whether making compliant drones available on the GSA schedule, prototyping universal controllers, or developing drone swarm capabilities, DIU continues to drive DoD's ability to rapidly identify, vet, and tailor commercial UAS, their components, and the associated software for our use here and abroad.

Anduril's Long Range Sentry Tower System for UAS Detection, Tracking, and Identification (Anduril)

COUNTER-UNMANNED AERIAL SYSTEMS (C-UAS)

Quickly and efficiently scaling the production and sale of commercial UAS technology for defense against hostile aerial threats.

Drone surveillance and attacks on DoD installations are intensifying in their frequency and impact because of the increased availability of inexpensive commercial systems. Equally alarming is the relative ease of programming a drone for operations that can cause irreparable damage to our infrastructure and national security.

In 2019, DIU leveraged an extensive commercial network to identify and evaluate solutions that would protect military bases at home and abroad from future adversarial UAS threats. After careful evaluation, DIU partnered with Anduril Industries to develop autonomous, data fused, and AI/ML-enabled sensor technology to detect, identify, track, and defeat adversarial UAS.

In June 2021, 18 months after entering the problem space, DIU had solicited industry, tested prototypes, and finalized a $99 million contract with Anduril to make C-UAS available across the DoD and other U.S. agencies. Demand for this technology remains strong: Within 90 days of issuing the contract, SOCOM, CBP, and USMC made more than $35 million in purchases. C-UAS is currently operational in six sites around the world with expansion to 15 sites expected in 2022. Military installations now have the ability to procure C-UAS systems for defense against hostile aerial threats. Within DoD, this contract also leveraged the "as-a-service" model to drive potential cost savings by shifting responsibility of maintenance to the vendor provider and leveraging rapid iteration to enable a faster response to a constantly evolving problem.

> **"Instead of a user having to read the tracks and do some analysis, this system sends you a notification of a hostile threat with extreme accuracy."**
> —Special Operations Forces Operator

ELECTRIC VERTICAL TAKEOFF & LANDING (EVTOL)

Expanding mission possibilities by introducing all-electric, piloted aircraft that can move supplies and personnel around complex operating environments.

Though flying taxis may still seem futuristic and cost-prohibitive, there has been a decade's worth of commercial interest and investment to bring this new transportation modality to reality. This technology has the potential for high impact as it is uniquely suited to both military operations and public use cases, including search and rescue and supplies delivery.

In hopes of bringing this technology from concept to capability, DIU has provided $11 million in prototype contracts to help accelerate Joby Aviation's development of an all-electric, five-seat piloted aircraft. In addition to DIU's prototype contacts, our ability to provide access to test ranges and streamline the safety certification process allowed for increased flight hours, iterative prototyping, and rapid flight certifications. Our partnership, expertise, and resources served as a catalyst to Joby Aviation's swift technology maturation and ability to raise $1.6 billion in private equity prior to making its public trading debut in August 2021.

While still leveraging DIU's range access and support, Joby has joined the AFWERX's Agility Prime program for continued development. This nontraditional program accelerates the market for advanced air mobility vehicles and will provide continued support to facilitate design and deployment of optionally manned aircraft for developing DoD use-cases.

By enabling Joby Aviation's path to transition, DIU demonstrated an ability to identify and fast-follow emerging technology spaces where commercial research and development investment far outpaces the DoD's. The integrated partnership between DIU, Joby, and the USAF underscores the transformative power of public-private partnerships when interests and missions align and complementary resources are made available.

AFWERX, one of DIU's closest partners within the DoD innovation ecosystem, shares solutions that DIU can help bring to scale across the Services. For example, DIU's eVTOL project with Joby Aviation transitioned to AFWERX's Agility Prime, a USAF program devoted to bolstering the commercial market for advanced air mobility aircraft. Agility Prime, with continued support from DIU, will expedite commercial viability and enable full-scale production through financial, flight test, and regulatory support. This collective approach will streamline the various certifications needed to bring this technology to scale.

"DIU was instrumental in the AFWERX Agility Prime partnership with Joby Aviation. The development of advanced air mobility through this collaboration is a testament to the efficacy of public-private partnerships. DIU has played a critical role in identifying, prototyping, and scaling emerging commercial technology for the security and prosperity of our nation, all while being an amazing partner."
— Colonel Nate Diller, AFWERX Director

Electric vertical take off and landing aircraft by Joby Aviation (Eric Adams, Joby Aviation)

"The investment of the U.S. government through DIU has been a clear win-win. Access to testing resources accelerated Joby's efforts to mature and scale our technology, and the DoD gained insight into an emerging technology class as well as opportunities for early adoption — helping to position the United States as the global leader in the eVTOL industry."
—JoeBen Bevirt, CEO, Joby Aviation

CYBER

Protecting DoD 's computer networks and systems from all forms of cyberattacks in alignment with the U.S. Cyber Command and the National Security Agency.

FOCUS AREAS

Persistent Engagement
Engaging with adversaries in the cyber domain to update and improve DoD's cyber defense toolkit in response to real-world offensive measures.

Persistent Presence
Monitoring and analyzing adversarial activities in the cyber domain to improve DoD's situational awareness and facilitate information sharing with allies and partners.

Persistent Innovation
Expanding DoD's cyber toolkit to leverage the most advanced capabilities, tools, and techniques and maintain military-technical advantage over our adversaries.

In May 2021, the President issued Executive Order (E.O.) No. 14028, "Improving the Nation's Cybersecurity," declaring the prevention, detection, assessment, and remediation of cyber incidents as top national security priorities. In FY 2021, DIU's Cyber Portfolio transitioned three projects addressing this E.O. by delivering protection to DISA through digital network asset inventory software for the Department of Defense Information Networks (DoDIN) to enable software patching; protection to USCYBERCOM through commercial threat data feeds to identify malicious cyber activities; and protection to the USAF to provide deceptive environments to thwart and defend against adversaries.

"DIU has advanced our national defense by rapidly securing and deploying innovative commercial technologies for USCYBERCOM and the Department of Defense."
–General Paul Nakasone, Commander, USCYBERCOM & National Security Agency

PRIVATE 5G

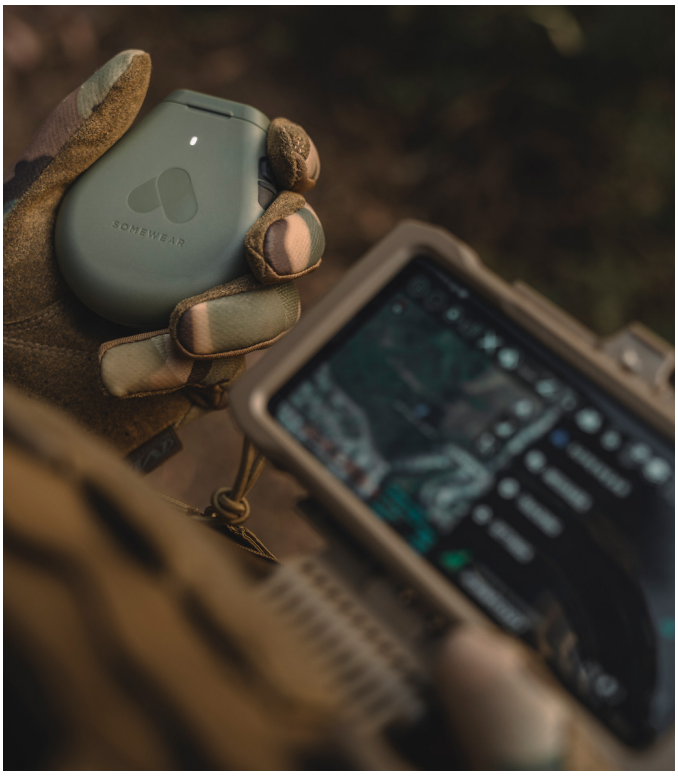
Partnering with the California National Guard to support modern, secure communications at the point-of-need.

National Guard members are routinely called to respond to emergencies, ranging from wildfires, hurricanes, riots, tornadoes, border security, and, most recently, a pandemic. These operations demand that guard members have seamless, scalable, and real-time communication capabilities. However, guard members are often limited to public, range-limited Wi-Fi, often supplemented by non-secure radios. While cable installation can support private communication channels, installation and management complexities can cause delays in remote operational environments.

Operators using a Banshee Tactical Radio in an austere environment. (Nokia/Fenix Group)

To help overcome these challenges and meet operational needs, DIU partnered with the California National Guard to quickly field 5G private network technologies. DIU has contracted with two companies — Nokia and Somewear Labs — to prototype these commercially available, mobile private 5G networks and provide reliable data and voice services to emergency responders operating anywhere, including austere environments. With initial contracts totalling $1.8 million, these commercial private 5G prototypes offer a cost-effective solution to military units.

> **"We believe this effort is the beginning of a transformation that will take civil and military emergency response teams from having multiple redundant radios in the field to having unlimited connectivity."**
> —Major General David S. Baldwin, Adjutant General of California



Somewear Lab's satellite communicator paired to a wireless device with Somewear's ATAK plugin. (Somewear Labs, Inc.)

HUNT FORWARD

Enabling persistent cyber engagement in contested partner nation environments.

Hunting Forward is a practice that enables U.S. defense teams to preempt cyber attacks by identifying and eliminating malicious, adversarial-led cyber activity as it occurs within partner or allied nation territories. Having put a higher priority on these missions, the USCYBERCOM Commander is requiring more teams and equipment to fight malicious cyber actors in unprotected and uncontrolled foreign networks.

Since hunt forward teams are deployed to foreign networks and terrain, they are not protected by traditional security controls present on U.S. government-owned and -operated systems. These teams therefore require a special toolkit that is capable of performing the hunt forward mission while mobile enough to be used in quick-reaction scenarios. Finally, the toolkit must not only be secure enough to protect and secure mission systems, but also to thwart adversary attempts to cause the teams and their systems harm.

In partnership with USCYBERCOM's Cyber National Mission Force, DIU facilitated a prototype for a portable threat hunting platform to find, report on, and eliminate adversarial activities on non-U.S. infrastructure being used as staging locations for cyberattacks against American systems. These toolkits have enabled hunt forward operators to conduct missions in 14 nations and to uncover and thwart our adversaries' intentions, methods, and weapons.

NETWORK OF THE FUTURE

Fast, secure, controlled access to cloud services directly over the internet.

DIU's Secure Cloud Management (SCM) project assessed several commercial-off-the-shelf (COTS) technologies that promised to deliver fast, secure, and controlled access to commercial cloud services. In FY 2020, DIU engaged with nontraditional technology vendors, all of whom proposed cloud access solutions that embrace Zero Trust principles. At the end of this yearlong project, DIU concluded that all solutions successfully achieved the project's objectives, and it submitted one for DISA authorization. The project is now transitioning and will be featured in the DIU's Completed Project Catalog for broader adoption and use. DISA recently noted that the SCM project influenced the Department to replace the existing Joint Regional Security Stack and further implement Zero Trust principles via their new project, Thunderdome.

> **"DISA partnered with DIU on the Secure Cloud Management project. The success of the SCM project influenced DISA's Thunderdome project, which will move the DoDIN toward a zero-trust architecture, thereby improving the DoD's cybersecurity posture."**
> —Steve Wallace, DISA Director of Emerging Technologies and Chief Technology Officer

This project, and the advanced threat-hunting project currently underway for USCYBERCOM, aims to advance and accelerate the protection and weapons of the nation's cyber warfighters. DISA and USCYBERCOM leadership rely on DIU's Cyber Portfolio to continue to bring the best-of-breed cyber solutions.

ENERGY

Leveraging advancements in the commercial sector to strengthen resilience on military installations and enhance operational energy capabilities.

FOCUS AREAS

Installation Resilience
Optimizing energy generation, storage, and delivery to ensure installation infrastructure is smart, secure, and efficient.

Operational Energy
Enhancing the range, duration, and efficiency of military platforms to optimize performance in contested environments and extreme conditions.

TACTICAL VEHICLE HYBRIDIZATION

Expanding operational capability and reducing logistics risk.

The commercial trucking sector has been converting its legacy fleets of long-haul, emergency, and utility trucks into hybrid vehicles for years. Now, in collaboration with the U.S. Army's Project Manager for Transportation Systems (PM TS), part of the Program Executive Office for Combat Support & Combat Service Support (PEO CS&CSS), DIU is bringing hybrid capability to the U.S. military.

The U.S. armed forces operate a fleet of more than a quarter million tactical vehicles that frequently work in austere environments. These vehicles often spend as much of their operational time stationary as they do in motion. Even when stationary, however, the engines must remain running to power their essential onboard electronics, as well as their crew compartments' heating and cooling systems. To meet operational demands, tactical vehicles consume significant amounts of fuel.

Starting with the Army's primary workhorse, the 2.5- to 10-ton Family of Medium Tactical Vehicles (FMTV) series of trucks, DIU and PM TS have begun the process of hybridizing the military's trucking fleet. DIU and PM TS issued prototype awards to two companies, XL Fleet and Volta Power Systems, to integrate their commercial solutions into prototype idle-reduction FMTVs. Upon successful demonstration and evaluation of those prototypes, the companies will develop and deliver a retrofit kit that soldiers operating at logistics depots and motor pools can easily install and field.

> **"The collaboration between DIU and PEO CS&CSS is proving to be invaluable. Their industry connections and contracting flexibilities greatly shorten the time to bring capability to the warfighter. These kits are the first step to a game changer across the tactical wheeled vehicle fleet in not only decreasing fuel demand, but also bringing new capability in the form of increased electrical power."**
> —Steve Roberts, PEO CS&CSS Project Lead, Integration

Two Army FMTV variants (PEO CS&CSS)

By reducing the FMTV's fuel consumption by up to 20% and expanding to additional tactical vehicles in the future, the TVH effort has the potential to help reduce DoD's petroleum consumption, which is over 80 million barrels annually.

JUMPSTART FOR ADVANCED BATTERY STANDARDIZATION

Accelerating the adoption of advanced battery technologies for military vehicle fleets.

In FY 2021, DoD began leveraging commercial investment in electric vehicle (EV) battery technologies to accelerate its capabilities and adopt advanced battery technologies for military use. This is a critical first step required to keep pace with technology advancements as the military begins electrifying vehicle fleets and platforms.

The primary goal of this project is to prototype standardized battery modules using COTS EV cells and components to accelerate the electrification of various military platforms. By creating battery standards and modules that span numerous military applications, this effort will accelerate the development and availability of militarized high-voltage batteries, cultivating an increased demand signal within DoD and reducing barriers required to work with industry.

There are a number of ongoing Service-level efforts, but this is the first OSD and inclusive project allowing EV battery manufacturers to test and develop standards required to adapt batteries for broad DoD applications. In addition to developing safety standards, specifications, and validating modules, this effort will further enable DoD to build relationships with the industry partners required to accelerate access to robust, state-of-the-art battery manufacturing capabilities.

DIU established the Advanced Energy and Materials Portfolio in late 2020 based on a clear demand from our DoD partners and the opportunities for dual-use commercial technologies in the energy sector and the associated material requirements. Over the past year, backed by very supportive DoD operational energy and installation communities, DIU has launched multiple energy-centric projects through its CSO process. It is now clear there are more than enough DoD problems seeking commercial solutions from the energy sector that DIU has decided to focus this portfolio on the department's energy needs. As such, DIU has renamed the portfolio from "Advanced Energy and Materials" to "Energy." Meanwhile, DIU will continue to take on materials projects in the appropriate Portfolio; for example, the Autonomy Portfolio has a number of additive manufacturing projects and the Space Portfolio has looked at various materials projects in its technology sector.

HUMAN SYSTEMS

Optimizing the human system and its enabling platforms through enhanced equipment, innovative training, and novel health applications.

FOCUS AREAS

Tactical Performance
Optimizing current capabilities and introducing new technology to continuously improve the warfighter's ability to shoot, move, and communicate.

Survivability
Leveraging biotechnology and biomedical applications to enhance warfighter performance, recovery, and detection capabilities.

Readiness
Introducing technology that advances warfighter training, personnel management, and testing capabilities to enhance force readiness.

RAPID ANALYSIS OF THREAT EXPOSURE (RATE)

Identifying illness before symptoms arise and preserving force readiness in operational and non-operational environments.

RATE uses COTS wearables that leverage algorithms based on hospital infection data to predict infections up to 48 hours before symptoms appear. This early warning allows commanders to shift to a predictive health model and identify sick individuals while they are pre-symptomatic and capable of transmitting a virus.

In December 2020, DIU, DTRA, DARPA, Texas A&M, the Naval Medical Hospital San Diego, the Air Force Research Laboratory, the Palo Alto Veterans Association, and Philips initiated a study to train a predictive health algorithm on more than 150 positive COVID-19 cases. These early tests enabled infection prediction with up to 60% accuracy. In April 2021, the team implemented another improved algorithm, which predicted COVID-19 infections with 73% accuracy and an average of 2.5 days prior to exhibiting symptoms. In addition to predicting symptomatic COVID-19 infections, RATE also predicted asymptomatic COVID-19 infections and breakthrough Delta variant cases from members that were fully vaccinated. The RATE study successfully concluded in September 2021 and involved more than 11,000 participants, 550 observed COVID-19 infections, and 201 million hours of wear-time data.

Although not the focus of the RATE study, the algorithm also detected a variety of other illnesses, that were diagnosed by a physician, including soft tissue infections, kidney infections, and noroviruses. Wider adoption of predictive health wearables, like RATE, could help stem the spread of infectious disease within the ranks, allowing DoD to better maintain force readiness and grant civilians actionable information about their personal wellbeing.

PILOT TRAINING TRANSFORMATION (PTT) & VIRTUAL INSTRUCTOR PILOT EXERCISE REFEREE (VIPER)

Forging a training solution that will affordably and sustainably enable pilot readiness.

Pilot training is one of the most dangerous and costly training courses in the DoD. According to USAF financial management, it costs over $2 million and nearly 18 months to train a single fighter pilot. The opportunities to reduce instructor workload, reduce risk, and minimize costs are numerous in such an expensive and lengthy program.

USAF instructor pilot conducts initial acceptance testing of DIU's Pilot Training Transformation device (Vertex Solutions, Inc.)

Learning science informs us that adults learn most quickly and deeply when training is self-directed with wide access to information, practice, and mentorship. Recognizing this, DIU's PTT platform pairs virtual reality simulators with an open-source learning management system and a cloud-first architecture to create an all-new learning environment that is accessible anywhere. PTT puts data at the heart of learning, creating opportunities for individualized syllabi that continually adapt to students' needs; it also provides feedback for instructor quality and helps commanders manage resources to optimize performance across the enterprise.

In the last 12 months, DIU deployed a platform across every USAF fixed-wing undergraduate pilot training base for use in the T-6 and T-38 programs. The Beta platform proved so successful that it has been expanded to create a classified version for use in mission training for the B-52 and F-16 and a rotary wing version for undergraduate helicopter training using the UH-1N. The Navy is also beginning to deploy versions of the platform on the T-6B and T-45. To date, more than150 Beta devices are in use or on order. The USAF expects the devices will go into production in 2022 for deployment and immediate use across the USAF pilot training enterprise. Early PTT experimentation and analysis has shown a two-thirds reduction in cost and training time.

> **"DIU's technical expertise was critical to our success. Their acquisition process gave us access to a broader and more capable set of industry ideas than we would have seen otherwise, then put a prototype in our hands to evaluate quickly."**
> —Col Kevin Pritz, USAF, 19th AF/A5

Another key development of the program is a first-of-its-kind intelligent tutor designed to train pilots without direct instructor pilot supervision. DIU matured the AI flight instructor, known as VIPER, following earlier USAF development. In 2021, VIPER became the first intelligent tutor certified by the USAF to instruct students in basic aerobatic maneuvers. Thanks to the combination of VIPER and the PTT platform, students can practice basic maneuvers and demonstrate progress to their instructors. Instructors will have more flexibility to instruct higher-order skills, producing better students faster with a more standardized instructional baseline. Not only was this an advance for learning science, it was a significant advance for AI.

PHYSIOLOGICAL STATUS MONITORING (PSM)

Monitoring and protecting the most important aircraft assets—the pilots.

In 2014, an experienced pilot was killed when his F-15C Eagle crashed in the mountains of Virginia because of sudden pilot incapacitation; one cause is from unexplained physiological episodes (UPEs) — anomalies that impair a pilot's abilities. There are currently no fielded sensors that monitor pilots' physical states while flying; no sensors that would be able to detect these life-threatening anomalies. DIU partnered with the Air Force, the ANG, and the Navy to prototype commercial sensors that can detect UPEs in-flight.

In FY 2021, testing for one of these devices called SPYDR expanded to operational ANG units, to include the same unit that lost their pilot in 2014. The project is currently completing tests on four discrete capabilities to include a biometric sensing shirt, blood oxygen monitors, and airflow sensors. One of these sensors has recently received a fielding recommendation for use in the F-15C Eagle.

> **"The adaptability of devices and team makes for an impacting foundational cornerstone capable of keeping up with the rapidly-changing science on fighter physiology."**
> —Lt. Col. Justin Elliott, Commander USAF Air Demonstration Team (Thunderbirds)

USAF instructor pilot conducts initial acceptance testing of DIU's Pilot Training Transformation device (Vertex Solutions, Inc.)

SPACE

Developing transformative commercial technologies to broaden DoD's access to space, persistent satellite capabilities, space logistics, on-orbit servicing, assembly and manufacturing services, and broadband space data transfer.

FOCUS AREAS

Persistent Remote Sensing for Peacetime Indications and Warning
Improving situational awareness with less-expensive, day/night, all-weather commercial imaging satellites as a service.

Low-Cost, Responsive Access to Mission-Designated Orbits
Precisely launching low-cost, commercial spacecraft up to mission-designed orbits on demand and as a service.

Hybrid Space Architecture Providing Reduced Latency, Secure Communications
Space internet that connects military, civil, and commercial space capabilities in a software-defined, secure, internet of things environment to address communications bottlenecks while delivering timely and assured information to users.

Assured Position, Navigation & Timing for All
Leveraging quantum sensor technology and advanced analytics to mitigate GPS interference and deception.
High Specific-Energy Batteries and Power Management
Significantly increasing the duty cycle of space systems with U.S.-manufactured high-specific energy batteries.

On-Orbit Logistics Enabling Agile and Sustainable Operations Beyond LEO
Accelerate adoption of modular and scalable solutions providing low-cost, responsive access to geosynchronous equatorial orbit (GEO), cislunar, and other exotic orbits beyond LEO to constitute an in-space logistics infrastructure benefiting commercial, civil, and national security space.

SYNTHETIC APERTURE RADARS

Enabling faster, more capable, and higher-quality satellite images, day or night, all-weather.

DIU continues to play a central role in expanding DoD's access to domestic commercial synthetic aperture radar (SAR) small sats, which provide the means to deliver high-quality imagery from space day or night, and even through inclement weather, at a fraction of traditional costs. Following a first-of-its-kind deployment of a U.S.-based SAR capability in 2020, DIU's commercial partner Capella Space facilitated a four-fold increase in its network of domestic SAR sensors in 2021, expanding coverage and revisit rates. Capella was established in response to a 2016 Hacking4Defense DoD Challenge at Stanford University and went on to win a DIU contract a year later. Its growth story is a testament to the value of DoD reaching out to nontraditional vendor solutions at different levels of technological readiness.

Another DIU commercial partner, Meta Orbital Effects, dramatically improved its SAR processing technology, increasing ortho-rectification precision (i.e., the conversion of a raw image into a one that is planimetrically accurate) and reducing processing time from several minutes to under 90 seconds.

These U.S. companies are on track to augment DoD and U.S. government imaging systems and have enough capacity to deliver meaningful, responsive access to high-fidelity SAR imagery for tactical users by 2025.

Yongbyon Nuclear Research Facility, North Korea, 09-19-2021
(Meta Orbital Effects)

Electric kinetic sub-orbital accelerator (SpinLaunch)

RESPONSIVE LAUNCH

Facilitating cost-effective launch at the point and time of need.

DIU's Responsive Launch contracts exemplify our ability to locate and energize commercial companies building transformative solutions to some of the DoD's most pressing needs. Small and responsive space launch vehicles assure our nation's access to space and offer the means to precisely deliver payloads cost effectively to their mission-designed orbits.

Three responsive launch companies under contract with DIU, in coordination with the United States Space Force's Space Systems Command and the DoD Space Test Program, achieved key advancements in 2021. Astra and VOX Space demonstrated responsive and flexible scheduling and launch positioning, which will enable the DoD to quickly coordinate a launch at a time and place of its choosing. In November 2021, SpinLaunch publicly debuted its unique kinetic launch capability, demonstrating the potential for high-cadence, low-cost launches for small satellites while reducing environmental impact. DIU is an early adopter of these technologies, giving this nascent section of the U.S. space economy much needed backing from the DoD. In aggregate, DIU projects significant cost-savings over the next 10 years as the availability and use of DIU-partnered launch partners continues to grow.

ELECTRIC PROPULSION FOR HIGH-VOLUME CONSTELLATIONS

Providing longer-lasting and more resilient methods of improving satellite maneuverability while extending operational life.

In partnership with Apollo Fusion, DIU is making it easier for spacecraft to integrate electric propulsion (EP) systems by reducing cost and simplifying integration complexity. Hall Effect Thrusters are a type of EP system that are ideally suited for on-orbit maneuvers and efficient orbital transfers which enable LEO constellation spacecraft to execute more dynamic missions over the course of their lifetimes.

Apollo Fusion's modern design and manufacturing processes offer resiliency against supply chain disruptions, improve efficiency, reduce parts count, and increase compatibility across a wide variety of spacecraft. By injecting simple and reliable electric propulsion into the market, Apollo Fusion and DIU provide a longer-lasting and more resilient method of improving satellite maneuverability and extending their operational life by months or years. With less than $1 million, the U.S. government was able to qualify, integrate, and establish flight heritage in an operationally relevant environment—a critical entrance criteria for use on both commercial and DoD spacecraft.

Artist rendering of Apollo Fusion's Hall Effect Thruster integrated on a SpaceFlight Inc. Sherpa-LTE bus (Apollo Fusion)

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