DEFENSE INNOVATION UNIT

ANNUAL REPORT

FY 2022

WWW.DIU.MIL

Belarus-Ukraine Border Pripyat River
51.5136 Lat 2V 800 Long
02/24/22 07 PM UTC
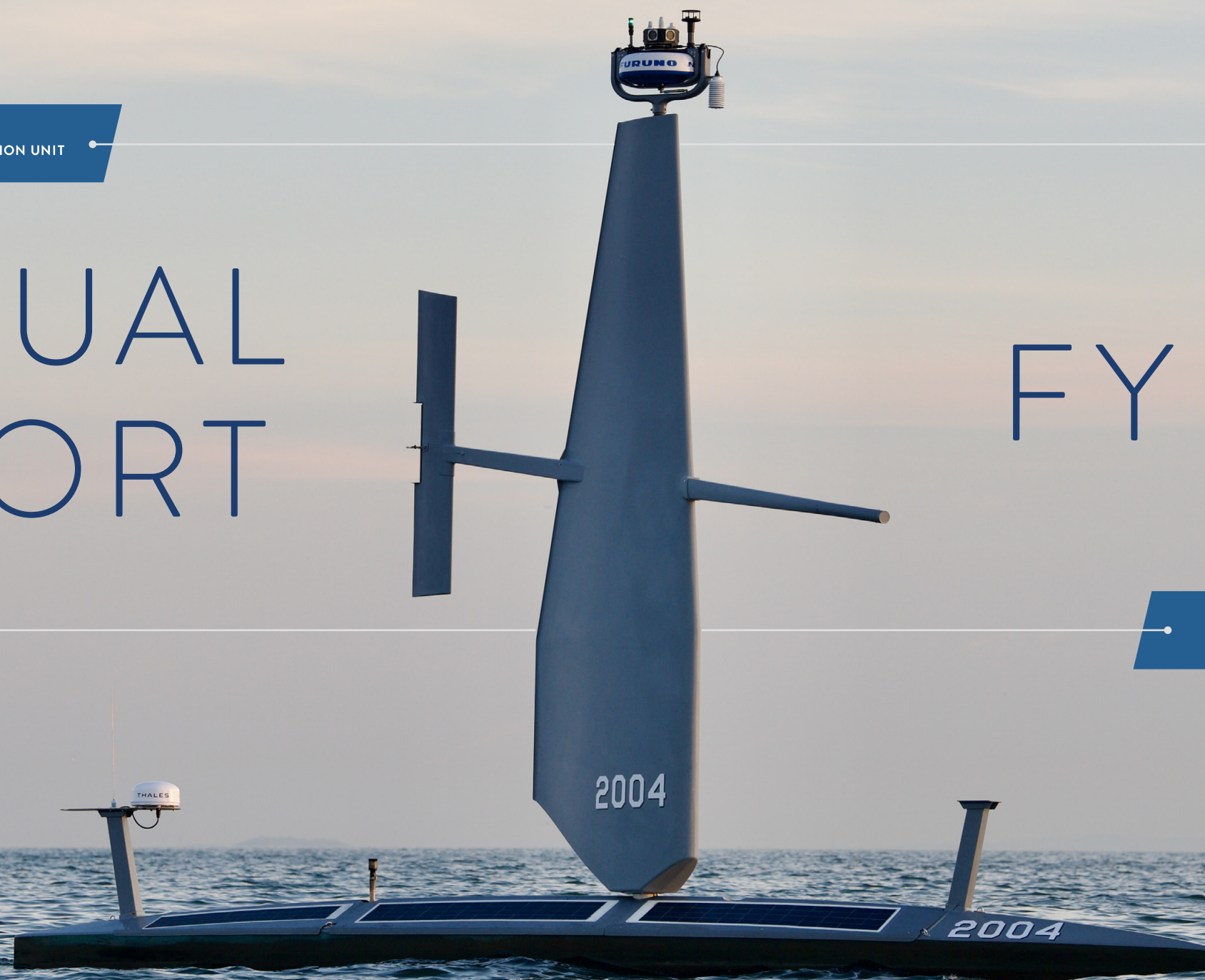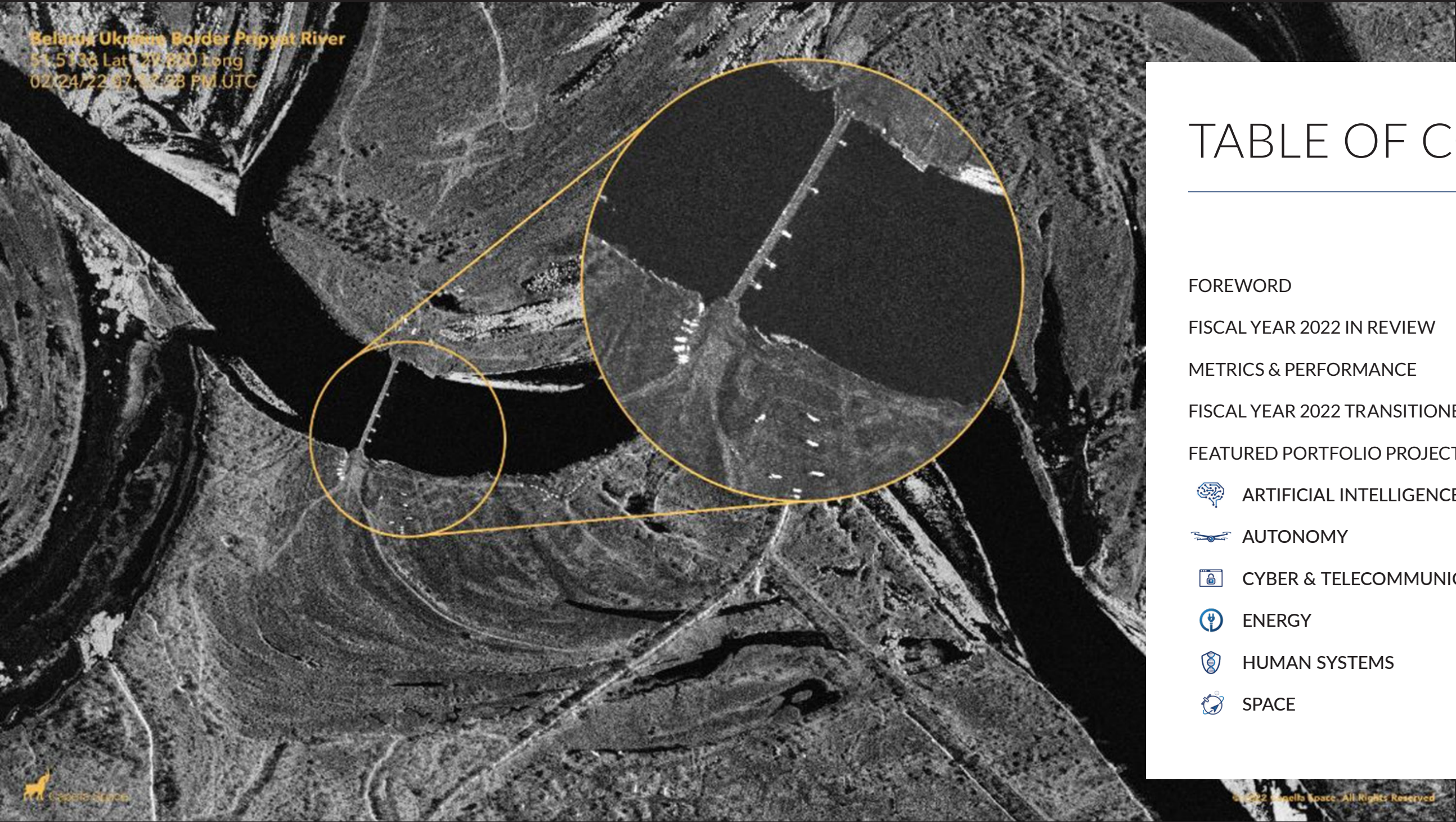
Belarus-Ukraine Border, Pripyat River (Source: Capella Space)

Cover photo generously shared by Saildrone.

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# FOREWORD

The threat matrix the United States (U.S.) faces today is significantly more diverse than in previous eras. Former Secretary of Defense Ash Carter foresaw this in 2015 when he established the Defense Innovation Unit (DIU). While the Department of Defense (DoD) continues to develop offensive and defensive capabilities around conventional military platforms, dual-use emerging technologies are changing the nature of warfare. This is evident today in Ukraine, where commercial satellite imagery, autonomous drones, communication tools, and social media are being democratized and used in new ways in the name of national defense.

The U.S. military will enjoy neither a time nor a technology advantage if our adversaries achieve more agility in adopting and integrating commercial technology into their warfare tactics. To gain and maintain operational advantage over competitors, the DoD requires an order of magnitude increase in its adoption of commercial technologies. To this end, DoD must act as a fast follower.

DIU, the experiment that was started seven years ago, is now scaling at a significant pace, with 17 transitions in FY 2022 — the highest in a single fiscal year in DIU's history — raising our cumulative transition rate to 47%. Through our use of the Other Transaction (OT) authority and the Commercial Solutions Opening (CSO) process, DIU has demonstrated that DoD is capable of rapidly prototyping and competitively sourcing cutting-edge technology as well as lowering the barriers to entry for small, non-traditional, and first-time companies.

DIU is efficiently integrating commercial technology and methodologies into the DoD to enable a modern and agile Joint Force. With our sister organizations, the National Security Innovation Network (NSIN) and National Security Innovation Capital (NSIC), we are helping to build enduring advantages by strengthening our national security innovation base and transforming our military capabilities and capacity.

"WE WILL BE A FAST FOLLOWER WHERE MARKET FORCES ARE DRIVING COMMERCIALIZATION OF MILITARILY RELEVANT CAPABILITIES IN TRUSTED ARTIFICIAL INTELLIGENCE [AI] AND AUTONOMY, INTEGRATED NETWORK SYSTEM OF SYSTEMS, MICROELECTRONICS, SPACE, RENEWABLE ENERGY GENERATION AND STORAGE, AND HUMAN-MACHINE INTERFACES."

— 2022 NATIONAL DEFENSE STRATEGY

"OUR DEFENSE INNOVATION UNIT IS FOCUSED ON IDENTIFYING PRIORITY TECHNOLOGY AREAS, USING FASTER METHODS TO GET THAT TECH INTO THE HANDS OF OUR WARFIGHTERS."

— SECRETARY OF DEFENSE LLOYD AUSTIN, REAGAN NATIONAL DEFENSE FORUM, DEC. 2022

Service member preparing to launch senseFly's eBee TAC in flight demo (Source: SenseFly)

Fire at Port Berdyansk, Ukraine
(Source: Planet Labs PBC)

# FY 2022 IN REVIEW

DIU is the DoD's primary conduit for identifying, prototyping, and scaling cutting-edge, dual-use technology. By leveraging flexible acquisition tools and forging more pathways for the Services and Combatant Commands to buy technology at speed and scale, DIU is making it easier than ever for commercial vendors to do business with the DoD. Our Fiscal Year (FY) 2022 Annual Report highlights the many ways in which DIU has collaborated with commercial innovators to deliver critical capabilities to our service members.

## SEVENTEEN TRANSITIONS IN FY22
DIU's momentum in production contracts is accelerating, with ceiling totals and averages growing substantially year-over-year. DIU's record-breaking 17 transitions in FY22 equate to $1.3B in contract award ceilings — more than double the eight transitions during FY 2021. With appropriate resourcing for DIU, we anticipate both total transitions and contract ceilings to grow, signaling increased adoption, revenue, and scale for vendors across the nation.

## COMMERCIAL SUPPORT TO UKRAINE
Since February 2022, countless images and videos have surfaced on social media and in the press depicting Russia's illegal and unprovoked invasion of Ukraine. In particular, commercial remote sensing companies, such as BlackSky, Capella, and Planet Labs, are providing satellite images of Russian military activities in Ukraine, generating an unprecedented level of visibility and driving accountability.

These companies — each of which have received prior prototyping agreements with DIU to develop and demonstrate their ability to supplement existing constellations of U.S. intelligence satellites — are part of a network of commercial companies that are meeting an ever-growing industry demand for overhead imagery. By 2030, it is estimated that there will be 1,000 commercial remote sensing systems for every government satellite orbiting the Earth.

On the ground, commercial small Unmanned Aerial Systems (sUAS) vendors have been providing sUAS equipment, training, and technical support that are helping Ukrainians with Intelligence, Surveillance, and Reconnaissance (ISR), humanitarian, and other efforts. This is making a difference by enabling Ukrainian commanders to have greater situational awareness, improved sensor-to-shooter capabilities, and faster maneuver in complex environments.

Technology from DIU's Advanced Cellular Communications project replaces expensive, limited, and proprietary battlefield communication systems. These tools are often limited to voice, and they create stovepipes that require users to carry one device per network. Our commercial partners have worked with the U.S. government to provide relevant capabilities to the Ukraine Ministry of Defense, allowing for increased battlefield awareness and communications security.

These overhead and on-the-ground contributions by commercial technology providers have underscored the benefits of dual-use technology capabilities in preparing for and deterring our next conflict.

## CONNECTING WITH NEW COMPANIES AND CAPABILITIES AT HOME AND ABROAD
Since 2016, DIU has operated in four technology ecosystems around the country — Silicon Valley, Boston, Austin, and Washington, DC — to help to identify and attract best-of-breed commercial technology to the DoD. In April 2022, DIU established a fifth office in Chicago as part of a broader regional outreach strategy to connect DoD to companies, labs, accelerators, academic partners, and investors in burgeoning innovation ecosystems. Since launching its new office in Chicago, the Midwest region has experienced a tripling in vendor submissions from FY21 to FY22.

In 2022, DIU launched its "Regional Roadshow," a new initiative focused on engaging with vendors and investors in regionally dispersed innovation and investment communities and educating them about DIU's mission and processes.

The Regional Roadshow consisted of four in-person and virtual conversations in Colorado, North Carolina, Illinois, and Georgia throughout FY 2022. This effort has helped expand our rolodex of venture capitalists and companies, and has increased the number of submissions to DIU's solicitations. Notably, DIU saw a 700% increase in vendor submissions from North Carolina between FY 2021 and FY 2022 following a Roadshow and continued outreach in the state.

> "[PEO DIGITAL'S] PARTNERSHIP WITH DIU LED TO THE SUCCESSFUL AWARD OF FIVE OTAS VALUED AT $15M, INFUSING NEW PROCESSES AND TECHNOLOGIES INTO PEO DIGITAL'S WEATHER PORTFOLIO."
>
> — HEIDI INGRAHAM, SENIOR CONTRACTING OFFICIAL, PEO DIGITAL

Finally, DIU recognizes that good ideas can come from anywhere in the world. Commercial technology strengthens relationships with international partners; it allows us to share our greatest innovations more freely and quickly without the complication of classification. This use of technology internationally also tends to foster interoperability. As such, in addition to our domestic strategy, DIU also sources technology solutions from ally and partner nations, ensuring that our service members have access to the best technology from around the world.

## STREAMLINING ACQUISITION & SCALING CAPABILITIES
DIU aims to make it easier for DoD partners to find and buy dual-use technology. By the same token, we recognize that DoD must remain an attractive business partner to our National Security Innovation Base (NSIB) vendors. To that end, DIU launched several initiatives in 2022 to expand the adoption of flexible contracting tools and acumen across the DoD, namely the Immersive Commercial Acquisition Program (ICAP) and a pilot project with the U.S. Air Force's Program Executive Office (PEO) Digital. In fact, leveraging their own contracting authority, PEO Digital awarded five prototype contracts using DIU's CSO process. Three of the five vendors — Greensight, Muon Space, and Windborne Systems — were first-time vendors for PEO Digital.

In addition to launching these training initiatives, DIU established new acquisition pathways for government entities to buy commercial solutions, including the DIU Commercial Solutions Catalog and an innovative partnership with the General Services Administration (GSA) to streamline onboarding of successfully prototyped DIU technology solutions to GSA contract vehicles. Since launching the partnership with GSA, one DIU non-traditional defense vendor — Saildrone — was added to the GSA Schedule and recorded $7.4M in sales in four months, providing much needed autonomous system technology quickly and easily to our nation's service members.

## ACCELERATING EMERGING HARDWARE TECHNOLOGIES
National Security Innovation Capital (NSIC) is a program within DIU dedicated to addressing the shortfall of trusted private capital for very early stage hardware startups that are developing cutting-edge, dual-use technology. NSIC identifies promising startups developing products critical to economic competitiveness and national security. It vets the companies to ensure that they have not received capital from adversarial sources. NSIC's funding enables the companies to achieve their next major milestones, thereby reducing their technical risk and enabling them to raise future capital from private sources.

Since its inception in 2021, NSIC has received $20M in Congressional appropriations. In 2022, NSIC down-selected 12 U.S. companies from an initial applicant pool of well over 230, and it funded these companies via the Other Transaction (OT) authority prototype development contracts ranging from $600K to $3M each. In the vetting process, three companies were discovered to have investors or advisors with adversarial connections. The companies were informed and resolved those issues. Excepting unavoidable supply chain disruptions, all but one of the 12 portfolio companies has been delivering on their technology and product development plans.

Three companies have already raised new funding from vetted private sources at substantially higher valuations, thanks to the technical progress the companies achieved using NSIC funds. The amount of new private funding ranged between six to more than 20 times the amount provided by NSIC.

## ENGAGING THE NSIB THROUGH THE NATIONAL SECURITY INNOVATION NETWORK (NSIN)
DIU's sister organization, NSIN, builds networks of innovators to generate new solutions to national security problems. Between 2019 and 2022, NSIN engaged 8,419 new people; helped 1,326 new companies enter the national security innovation base, yielding 48 DoD-funded technologies; and directly supported the launch of 15 dual-use ventures from extant DoD lab technology. NSIN has also supported partner company expansion that raised about $9.6B in private capital since 2016 and $2.9B in DoD funding. Finally, in FY 2022, NSIN co-founded and launched the Pacific Northwest Mission Acceleration Center (MAC) in Seattle to make it easier for industry and the military to work together.

¹ "Smallsats by the Numbers 2020," Bryce Space & Technology, https://brycetech.com/reports/report-documents/Bryce_Smallsats_2020.pdf

# PERFORMANCE & METRICS

## ACCELERATING DOD ADOPTION OF COMMERCIAL TECHNOLOGY

DIU's momentum is accelerating across all of our key performance indicators. In FY 2022, DIU posted 36 new solicitations to our website, which represents a 38% increase from FY 2021. DIU received a record-breaking number of commercial proposals in response to our solicitations and awarded 12.5% more prototype contracts than in FY 2021 with a total value of $204.8M in prototype contracts.

Speed to award is critical: DIU strives to award prototype contracts 60-90 days after issuing a solicitation. In FY 2022, the average number of days to award a

contract was 142. To draw closer to our target, we are working to gain the human resources needed to further increase our contracting capacity.

Since FY 2016, DIU has directly facilitated the successful transition of 52 prototype contracts into follow-on contracts across DoD, totaling $4.9B in contract ceiling awarded across 48 companies backed by $18B of private capital. Of these 52 solutions, 16 commercial vendor solutions transitioned into a Program of Record, across multiple PEOs.
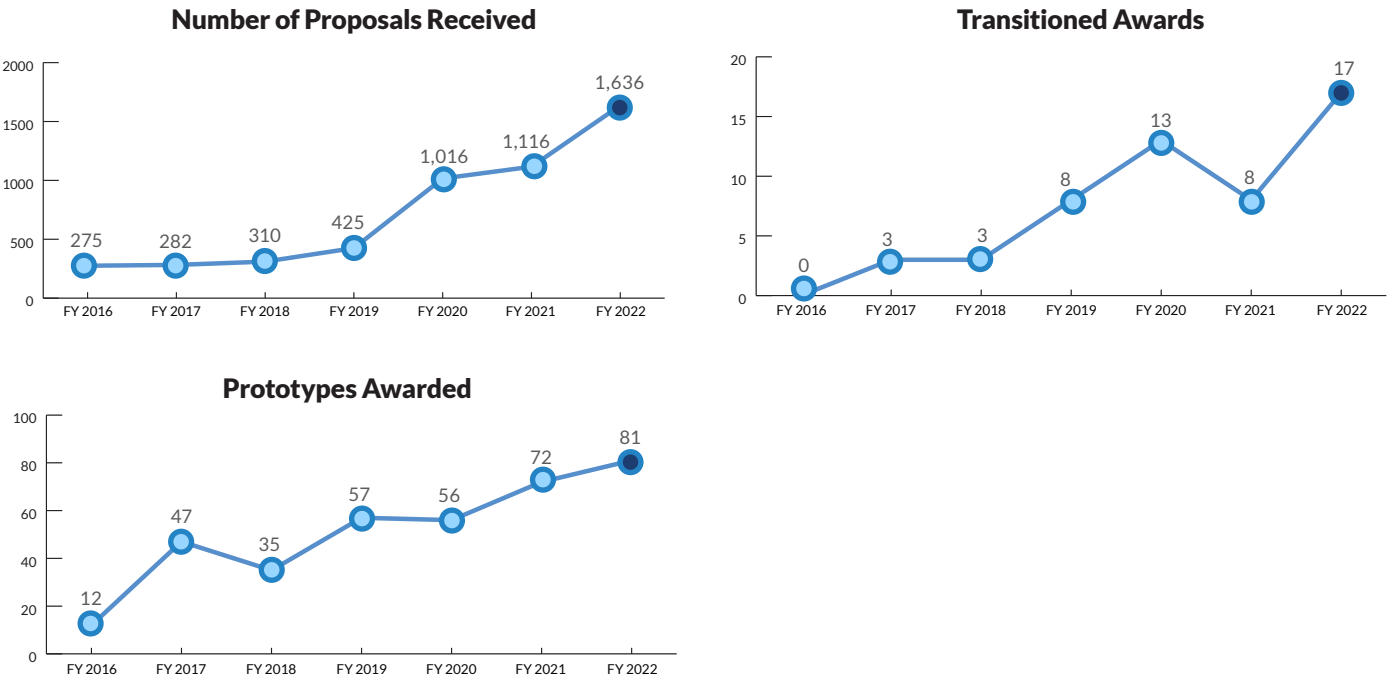
### FY 2022 Snapshot

**36**
solicitations for commercial solutions posted to diu.mil

**1,636**
commercial proposals received

**45**
average number of proposals received per solicitation

**132**
the most commercial proposals received in response to a single solicitation

**81**
prototype OT contracts awarded to commercial companies

**$204.8M**
total value of prototype OT contracts awarded to commercial companies

**142**
average business days to award a prototype OT

**17**
commercial solutions transitioned to DoD users

**$1.3B**
total contract ceiling value of DIU's 17 transitions in FY22

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**June 2016 – September 2022**

**52**
total number of commercial solutions transitioned to DoD users

**157**
prototype projects initiated to solve DoD challenges

**5,060**
commercial proposals received

**359**
prototype OT contracts awarded to commercial companies

**57**
projects have been completed (all prototyping efforts concluded)

**$30B+**
in private investment leveraged (as of Sept. 31, 2022)

**$4.9B**
total value of production OT (or other) contracts awarded to commercial companies

**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.

### Volume of Activity (Throughput) FY 2016 – FY 2022

**Number of Proposals Received**

| FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 |
|---|---|---|---|---|---|---|
| 275 | 282 | 310 | 425 | 1,016 | 1,116 | 1,636 |

**Transitioned Awards**

| FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 |
|---|---|---|---|---|---|---|
| 0 | 3 | 3 | 8 | 13 | 8 | 17 |

**Prototypes Awarded**

| FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 |
|---|---|---|---|---|---|---|
| 12 | 47 | 35 | 57 | 56 | 72 | 81 |

## TRANSFORMING MILITARY CAPABILITIES AND CAPACITY

Widespread technology adoption is necessary to transform military capabilities and capacity. DIU prioritizes projects that can address DoD-wide operational needs.

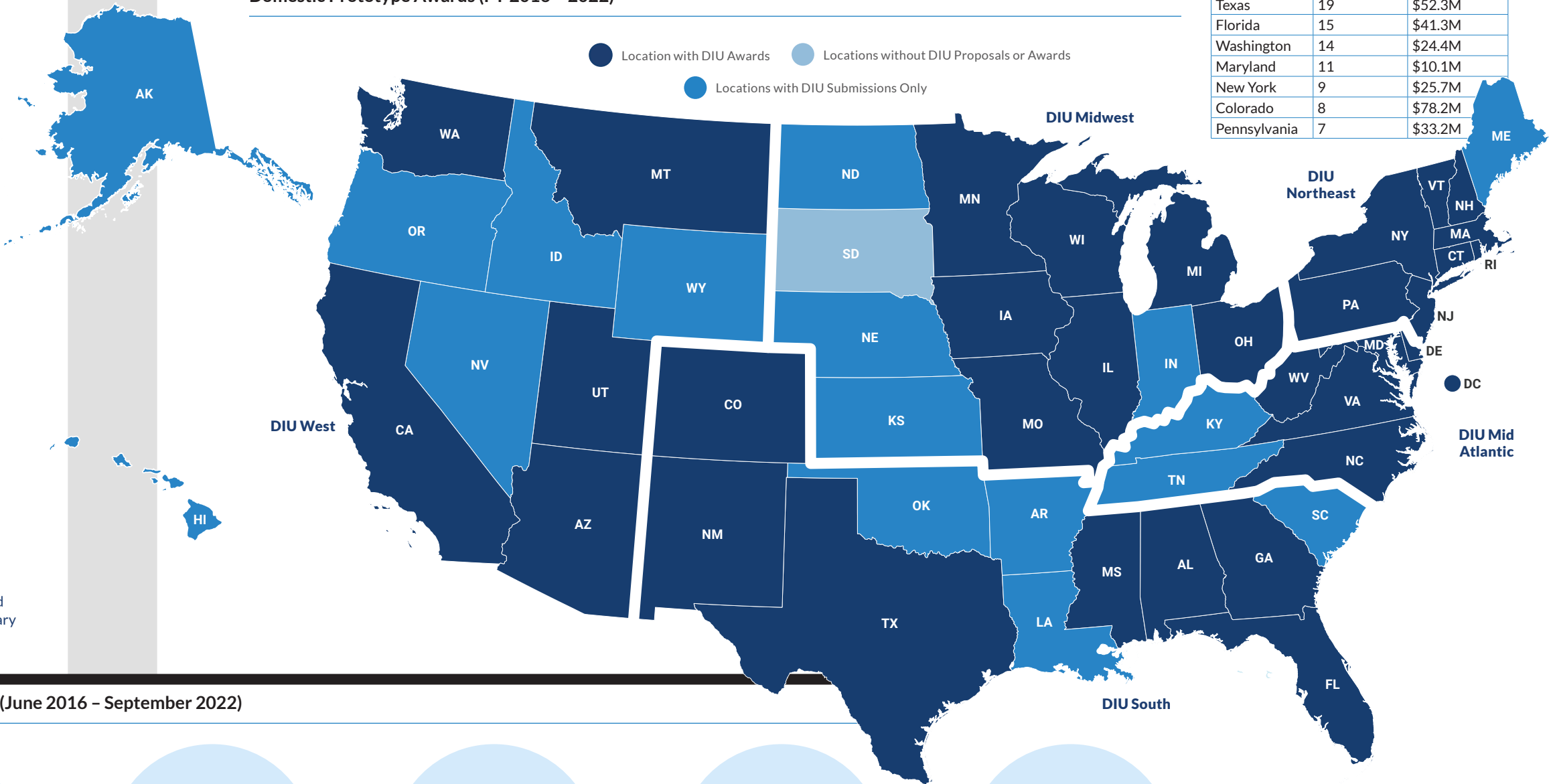### Obligated Prototype Funding Breakdown (FY 2022)

TOTAL
$205.3M

DIU
OSD/Other
USSF
USAF
USA
USN
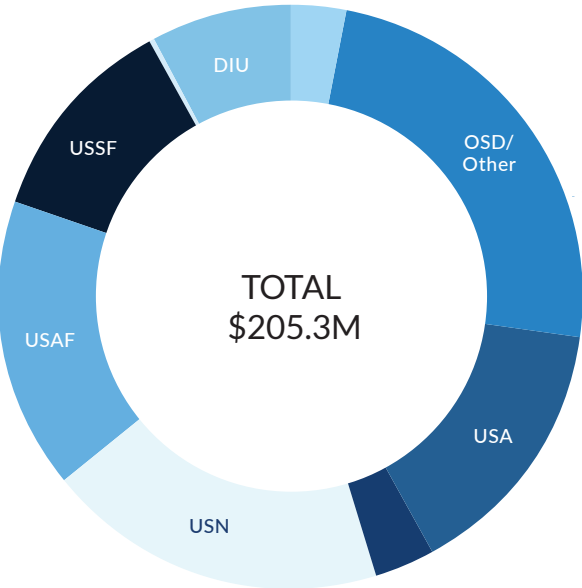
**DIU** = Defense Innovation Unit
**CCMDs** = Combatant Commands
**USA** = United States Army
**USMC** = United States Marine Corps
**USN** = United States Navy

**USAF** = United States Air Force
**USSF** = United States Space Force
**USCG** = United States Coast Guard
**OSD/Other** = Office of the Secretary of Defense

## STRENGTHENING THE NATIONAL SECURITY INNOVATION BASE[2]

Between June 2016 and September 2022, DIU awarded 360 OT Prototype contracts across 321 unique vendors with a total value of $1.2B. Additionally, since 2016, DIU has made contract awards to 19 foreign-based companies, with a total award value of $30.6M.

### Domestic Prototype Awards (FY 2016 – 2022)

Location with DIU Awards
Locations without DIU Proposals or Awards
Locations with DIU Submissions Only

DIU Midwest
DIU Northeast
DIU Mid Atlantic
DIU West
DIU South

### DIU Contracts by State (Top 10)

| State | Number of Contracts | Amount Obligated |
|---|---|---|
| California | 131 | $444.8M |
| Virginia | 48 | $192.4M |
| Massachusetts | 19 | $46.4M |
| Texas | 19 | $52.3M |
| Florida | 15 | $41.3M |
| Washington | 14 | $24.4M |
| Maryland | 11 | $10.1M |
| New York | 9 | $25.7M |
| Colorado | 8 | $78.2M |
| Pennsylvania | 7 | $33.2M |

## Obligated Prototype Funding by Portfolio/Technology Area (June 2016 – September 2022)

**ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**
41 AWARDS
$113.9M

**AUTONOMY**
132 AWARDS
$360.7M

**CYBER & TELECOMMUNICATIONS**
59 AWARDS
$106.3M

**ENERGY**
12 AWARDS
$19.5M

**HUMAN SYSTEMS**
53 AWARDS
$244.1M

**SPACE**
63 AWARDS
$326.1M
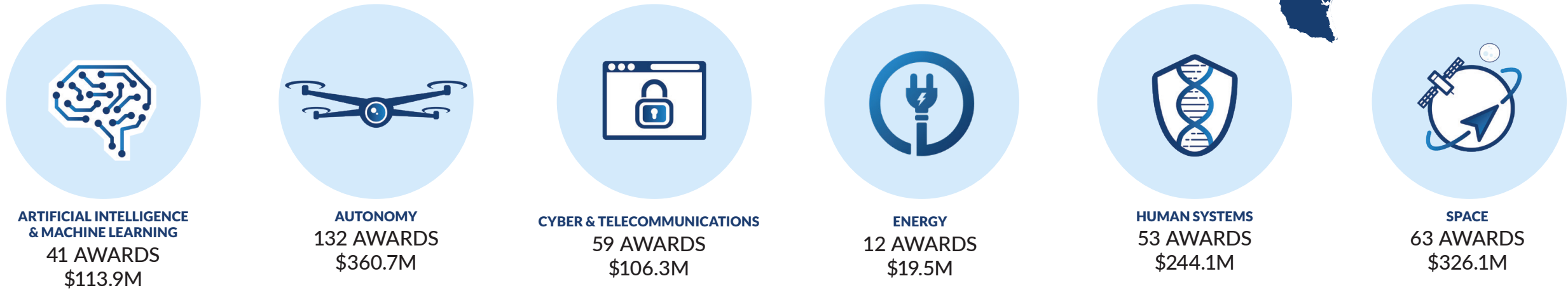
**GRAND TOTAL OF**
**360 AWARDS**
**AT $1.2B**

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

## International Prototype Awards (FY 2016 – FY 2022)



| Country | Number of Contracts | Amount Obligated |
|---|---|---|
| Australia | 2 | $9.5M |
| Canada | 5 | $3.4M |
| France | 1 | $4.8M |
| Israel | 2 | $2M |
| Norway | 1 | $186K |
| Portugal | 2 | $1.2M |
| Spain | 1 | $1.3M |
| Switzerland | 1 | $207K |
| United Kingdom | 5 | $7.6M |
| Grand Total | 19 | $30.6M |
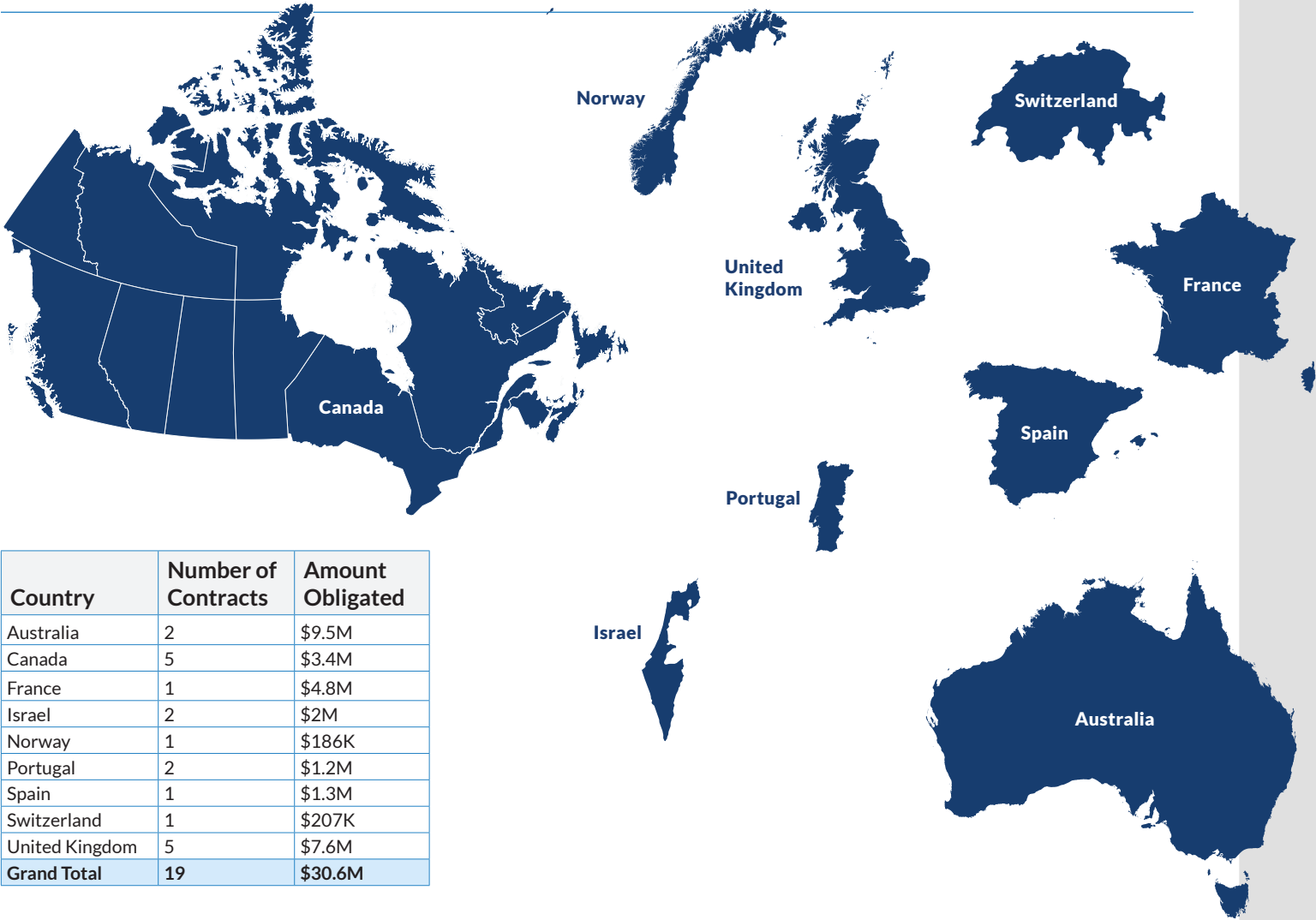
## Contract Award Recipients by Business Type[3]



39% of DIU Awardees are First-Time DoD Vendors

82% of DIU Awardees are Non-Traditional

74% of DIU Awardees are Small Businesses

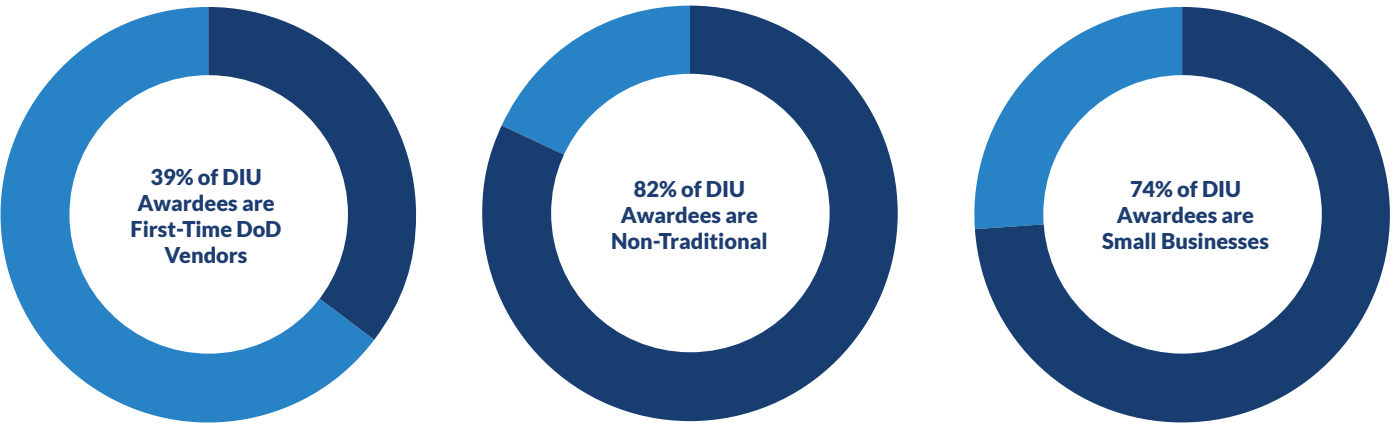[3]Note: A first-time DoD vendor has never before worked with the Department of Defense. A nontraditional defense contractor is defined in 10 U.S.C. § 2302(9) as an entity that is not currently performing and has not performed, for at least the one-year period preceding the solicitation of sources by 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.

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# FY 2022 TRANSITIONED PROJECTS

Revenue growth and predictability are the lifeblood of privately backed technology companies. Investors and entrepreneurs want to ensure that DoD prototyping and experiments lead to substantial production contracts with meaningful recurring revenue. Investors view production contracts as the true measure of whether DoD is serious about attracting non-traditional vendors and modernizing with commercial technology. This is why DIU focuses on transitions from prototypes to fielded capabilities through follow-on, multi-year contracts, such as Production Other Transactions (OTs), Indefinite Delivery/Indefinite Quantity (IDIQ), Blanket Purchase Agreement, and listings on the GSA schedule.[4]

At DIU, we define success as getting commercial capabilities into our service members' hands. In FY 2022, a total of 17 technology solutions transitioned to a DoD or federal government end-user, raising our cumulative transition rate from 41% at the end of FY 2021 to 47%. Across DIU's seven-year history, this represents the highest number of transitions in a single fiscal year.

**1**

Artificial Intelligence & Machine Learning Portfolio

**AI-BASED KNOWLEDGE GRAPHING:** Accrete's machine learning models automatically scrape, collect, translate, and process large volumes of open-source intelligence data and deliver a data processing capacity that enables DoD users to accelerate the identification of foreign adversary investments.

**Vendor:** Accrete
**Prototype Award Value:**[5] $1.9M
**Transition Agreement:** Production OT with $23.6M ceiling over five years
**Transition Partner:** DoD
**Transition Date:** September 15, 2022

**2**

Cyber & Telecommunications Portfolio

**AUTOMATED VULNERABILITY DISCOVERY AND REMEDIATION**
Current methods of finding unknown software vulnerabilities in current weapon systems do not scale. Grammatech's solution automates software vulnerability detection in weapons systems and other critical software.

**Vendor:** Grammatech
**Prototype Award Value:** $3.8M
**Transition Agreement:** Production OT five-year contract with a $45M ceiling
**Transition Partner:** U.S. Cyber Command (USCYBERCOM)
**Transition Date:** November 19, 2021

[4]Other short-term capital sources without a path to wide operational adoption—such as Small Business Innovation Research (SIBR) grants — do not represent the same recurring revenue opportunity, nor do they hold the same value in the eyes of private investors. DIU shares concerns raised by private investors: without a DoD-wide focus on delivering timely, sizable and recurring contracts to these growth stage companies, the DoD will not create sufficient economic incentives to stimulate private sector investment in national security technology. SBIR considers a follow-on dollar of investment as a successful transition which does not accelerate vendor success or field capability to warfighters.
[5]This refers to the current amount of money obligated from the time of the initial prototype award through Sept 30, 2022.

Saildrone "Voyager" model undergoing sea trials in the San Francisco Bay. Voyagers are specifically designed for ultra long endurance Maritime Domain Awareness (MDA) (Source: Saildrone)

**3**

Autonomy Portfolio

### AUTONOMOUS MARITIME ISR
Saildrone enables long endurance, persistent autonomous data collection and intelligence gathering in distant and hazardous maritime environments.

**Vendor:** Saildrone
**Prototype Award Value:** $3.63M
**Transition Agreement:** Production OT five-year $50M ceiling & General Services Administration (GSA) Schedule
**Transition Partners:** National Geospatial-Intelligence Agency (NGA), U.S. 5th Fleet (Task Force 59), U.S. Coast Guard (USCG), U.S. Customs and Border Protection (CBP)
**Transition Date:** September 22, 2022

### COMMERCIAL THREAT DATA
Greynoise Intelligence's Internet Background Noise scanning and analysis capabilities are providing the DoD cyber operations and intelligence communities with enhanced vision into computer based malicious activities and threats.

**Vendor:** GreyNoise
**Prototype Award Value:** $110K
**Transition Agreement:** Production OT five-year contract with a $30M ceiling
**Transition Partners:** USCYBERCOM & Service Cyber Components
**Transition Date:** October 28, 2021

**4**

Cyber & Telecommunications Portfolio

**5**

Cyber & Telecommunications Portfolio

### CYBER DECEPTION
The CounterCraft Cyber Deception platform allows for real-time adversary engagement for military cyber operators and analysts by using a series of decoys, honey items, and other deceptive elements.

**Vendor:** CounterCraft
**Prototype Award Value:** $1.354M
**Transition Agreement:** Sole-source production OT contract with a $26M ceiling
**Transition Partner:** Air Force Life Cycle Management Center
**Transition Date:** September 27, 2022

### HAWKER TEMPEST
Quantifind's machine learning (ML) technology helps DoD extract, structure, and transform multi-modal datasets from both English and non-English sources into useful knowledge graphs, identifying and mapping nefarious actors and networks across multiple threat vectors.

**Vendor:** Quantifind
**Prototype Award Value:** $3.7M
**Transition Agreement:** Production OT with a $23.6M ceiling over five years
**Transition Partner:** DoD
**Transition Date:** September 22, 2022

**6**

Artificial Intelligence & Machine Learning Portfolio

## SAILDRONE: PERSISTENT MARITIME INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

In 2016, the DoD entered into a prototyping contract with Saildrone to enhance mission effectiveness by providing a platform to collect critical data from diverse maritime environments. Saildrones are currently deployed in CENTCOM and will be used by the U.S. Coast Guard and U.S. Customs and Border Protection in FY 2023. Saildrone "Maritime Domain Awareness (MDA)-MDA-as-a-Service" can be purchased via the GSA Schedule or through an active DIU Production OT.

Cyber warfare operators assigned to the 275th Cyber Operations Squadron of the 175th Cyberspace Operations Group of the Maryland Air National Guard (Source: DVIDS)

**7**

Space Portfolio

**HALL EFFECT THRUSTERS (HETs) FOR SMALLSATS**
Under this effort, the Apollo Fusion Constellation Engine successfully demonstrated performance on-ground and on-orbit. HETs for small satellites continue to establish space heritage in terms of their design and integration in future space vehicles. This technology enables satellite integrators to increase navigational agility and extend the operational life of the satellites in support of both commercial and military space activities.

**Vendor:** Apollo Fusion (since start of this OT experiment, Apollo has been acquired by Astra)
**Experiment Value:** $960K
**Transition Agreement:** Indirect transition through the provision of more than 200 propulsion systems across the U.S. government and commercial partners for operational use. The propulsion system is the singular vendor for all satellite integration teams in the Space Development Agency's (SDA) transport and tracking layers, along with several commercial space vendors.
**Transition Partner:** Achieved via participation in the SDA Transport and Tracking layers.
**Transition Date:** Multiple in FY21 and FY22

## "SEALING IS PROUD TO BE SUPPORTING THE DOD CYBER OPERATORS WITH ADVANCED TECHNOLOGY AS PART OF THE HUNT FORWARD INITIATIVES. THE DIU PROCESS WAS VERY TRANSPARENT AND INNOVATIVE, WHILE STILL MAINTAINING COMPETITION. IN THE END, IT GETS THE DOD WHAT THEY NEED, FAST. RAPID, INNOVATIVE, AND COMPETITIVE."

— ED SEALING, CEO, SEALING TECH

**HUNT FORWARD**
Sealing Technologies designed a portable threat-hunting platform that includes hardware and software designed to find, report on, and eliminate adversary activities on non-U.S. infrastructure.
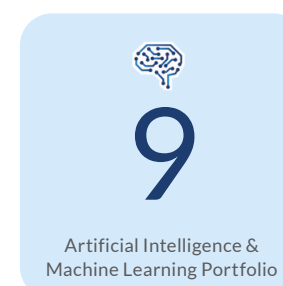
**Vendor:** Sealing Technologies
**Prototype Award Value:** $684K
**Transition Agreement:** Production OT with a $59M ceiling
**Transition Partner:** Cyber National Mission Forces (CNMF)
**Transition Date:** March 8, 2022

**8**

Cyber & Telecommunications Portfolio

# DOD CLOUD AUTHORIZATION: ACCELERATING COMMERCIAL CLOUD SOLUTIONS ONE IL AT A TIME

As detailed in the DoD's Software Modernization Report, to ensure software advantage, the DoD needs to allow greater access to cloud computing and storage. This has become a particularly valuable capability as more DoD members wish to access public cloud services from outside the DoD Information Network (DoDIN). After a two-year prototype phase testing three different solutions sets, DIU executed a Production OT agreement with Google in January 2022 to implement Secure Cloud Management (SCM) at DIU. Moving forward, DIU intends to submit Google SCM for provisional authorization as an alternative to the Defense Information Systems Agency's (DISA) Cloud Access Point (CAP).

DISA has publicly noted that the SCM project influenced the DoD to replace the existing Joint Regional Security Stack and further implement Zero Trust principles via their new project, Thunderdome.

Because of the success of the SCM program, DIU sponsored McAfee UCE (now Skyhigh SSE) for IL5 Provisional Authorization. IL5 Provisional Authorization allows authorized cloud service providers to process Controlled Unclassified Information (CUI) on behalf of the DoD, including Highly Sensitive CUI information considered part of a National Security System (NSS). It is a difficult but important authorization to achieve, requiring the placement of more than 500 security controls.

**9**

Artificial Intelligence & Machine Learning Portfolio

**INTELLIGENT BUSINESS AUTOMATION**
This solution automates the detection and correction of unmatched financial transactions (UMTs).

**Vendor:** Vendor: Summit2Sea
**Prototype Award Value:** $1.4M
**Transition Agreement:** $400K
**Transition Partner:** Office of the Undersecretary of Defense (OSD) Comptroller
**Transition Date:** October 15, 2021

### INTELLIGENT BUSINESS AUTOMATION
This solution automates the detection and correction of unmatched financial transactions (UMTs).

**Vendor:** VertoSoft/DataRobot
**Prototype Award Value:** $1.7M
**Transition Partner:** U.S. Army
**Transition Date:** February 23, 2022

**10**
Artificial Intelligence & Machine Learning Portfolio

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### PILOT TRAINING TRANSFORMATION
Modernized, data-enabled USAF pilot training powered by commercial gaming technology and secure cloud microservices architecture.

**Vendors:** CAE
**Prototype Award Value:** $7.9M
**Transition Agreements:** x2 FAR-based contracts with a total $8.1M ceiling
**Transition Partner:** 19th USAF
**Transition Date:** May 21, 2022

**14**
Human Systems Portfolio

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**11**
Space Portfolio

### PEACETIME INDICATIONS AND WARNING
Non-ITAR restricted remote-sensing capabilities originating from small-satellite platforms and associated data aggregation / exploitation capabilities from commercial platforms.

**Vendors:** Capella Space Corporation
**Prototype Award Value:** $10.6M
**Transition Agreement:** DoD
**Transition Partners:** DoD
**Transition Date:** January 20, 2022

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**15**
Human Systems Portfolio

### RAPID ANALYSIS OF THREAT EXPOSURE (RATE)
RATE uses commercial-off-the-shelf (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.

**Vendors:** Philips
**Prototype Award Value:** $1.8M
**Transition Agreements:** Prototype OT with a $739.2K ceiling over two years
**Transition Partner:** DIU
**Transition Date:** February 23, 2022

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### PEACETIME INDICATIONS AND WARNING
Non-ITAR restricted remote sensing capabilities originating from small-satellite platforms, and associated data aggregation / exploitation capabilities from commercial platforms.

**Vendors:** Orbital Insight, Inc.
**Prototype Award Value:** $10.1M
**Transition Agreement:** IDIQ with a $950M ceiling
**Transition Partners:** USAF
**Transition Date:** September 22, 2022

**12**
Space Portfolio

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### SECURE CLOUD MANAGEMENT
An off-the-shelf multi-cloud security gateway that controls access to cloud apps using zero-trust principles; supports secure cloud access through government and personal endpoints globally.

**Vendor:** Google
**Prototype Award Value:** $1.6M
**Transition Agreement:** Production OT with a $1.9M ceiling
**Transition Partner:** DIU
**Transition Date:** January 10, 2022

**16**
Cyber & Telecommunications Portfolio

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**13**
Human Systems Portfolio

### PILOT TRAINING TRANSFORMATION
Modernized, data-enabled USAF pilot training powered by commercial gaming technology and secure cloud microservices architecture.

**Vendors:** Carahsoft (Google)
**Prototype Award Value:** $14.1M
**Transition Agreements:** Prototype OT with a $739.2K ceiling over two years
**Transition Partner:** 19th USAF
**Transition Date:** March 31, 2022

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**17**
Autonomy Portfolio

### SHORT-RANGE RECONNAISSANCE
The Army's RQ-28A, utilizing the Skydio X2D, is a highly maneuverable small, multirotor UAS capable of day and night ISR missions, powered by AI-enabled autonomous flight control.

**Vendor:** Skydio
**Prototype Award Value:** $18.7M
**Transition Agreement:** $99.9M Production OT over five years
**Transition Partner:** U.S. Army PEO Aviation
**Transition Date:** November 19, 2021

# FEATURED PORTFOLIO PROJECTS

**As a joint organization, DIU works with defense partners across the Services and Combatant Commands — and sometimes civilian or intelligence agencies — to identify and scope projects that could have the largest potential impact on national security. The following section contains a selection of ongoing priority projects across our six technology portfolios that we believe can have an outsized impact and scale across the Department of Defense and the whole-of-government.**

## ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

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

Example of xView3 Model applied over European Space Agency Sentinel-1 Synthetic Aperture Radar Imagery; blue bounding boxes indicate vessel detections (Source: European Space Agency)

### XVIEW3 PRIZE COMPETITION

*Inspiring individuals and organizations to develop algorithms that advance computer vision to address global challenges.*

Illegal, unreported, and unregulated (IUU) fishing is a major threat to human food supply, marine ecosystem health, and geopolitical stability.[6] IUU fishing depletes global fisheries, aggravates the effects of climate change,[7] and is closely connected to other transnational crimes, including bonded labor, tax evasion, piracy, human rights abuses, as well as drug, arms, and human trafficking. U.S. adversaries, including China, use fishing vessel fleets not only to plunder the fisheries of other nations, but also to advance disputed territorial claims in the East and South China Seas.

IUU fishing is difficult to detect. Malicious actors operate dark vessels that do not broadcast radio transponder signals. They also deliberately manipulate or tamper with vessel transponders in order to conceal illicit or criminal activity while at sea. Cloud coverage, haze, seasonal darkness, and other natural events can also inhibit dark vessel detection among passive satellite sensors that use electro-optical imagery.

To address this challenge, DIU partnered with the USCG and Global Fishing Watch to launch an international prize competition, called xView 3, to develop ML models that

automate dark vessel detection, location, and sizing from persistent space-based Synthetic Aperture Radar (SAR). SAR imagery provides a robust dark vessel detection capability as it does not require vessel cooperation or cloud-free skies. Through this competition, DIU sought to advance beyond the challenge of identifying the presence of dark vessels, to an evaluation of the likelihood of active IUU fishing activity.

More than 1,000 teams across 67 countries participated. Winning solutions demonstrated that commercial SAR imagery can detect dark vessels three times better than baseline models, in all-weather conditions, providing timely and accurate information to relevant enforcement agencies. Early versions of the winning xView3 algorithms have been deployed to U.S. government-sponsored maritime domain awareness platforms, enabling allies and partners to better protect their fisheries from exploitation and plundering by state and non-state actors.

### HARMONIOUS ROOK

*Facilitating scalable, persistent awareness of position, navigation, and timing disruptions across the globe.*

Position, navigation, and timing technology, or PNT, is an essential, daily feature for private citizens and military operators alike. The PNT signals that inform GPS satellites to direct precision-guided munitions are similar to the ones that allow smartphone users to navigate the road with ease. PNT technology is critical

6 "Illegal, Unreported, and Unregulated Fishing," United States Coast Guard, https://www.uscg.mil/iuufishing/.
7 Voigt, Christina, "Oceans, IUU Fishing, and Climate Change: Implications for International Law" International Community Law Review, 22, (2020), 377-388, 377-388, 2020, https://www.duo.uio.no/handle/10852/84927.

to commercial industry, generating more than $1.4T over the last 10 years for the private transportation, commerce, finance, and power sectors.[8] Predictive models indicate that a PNT outage spanning even a few days could cost the private sector billions of dollars.

Despite being a critical infrastructure, GPS users remain vulnerable to PNT deception and manipulation, which is why the degradation or denial of GPS-enabled capabilities is a significant concern.

In the Fall of 2021, DIU launched the Harmonious Rook prototype project to address the need for scalable, persistent awareness of PNT disruptions across the globe. By mapping GPS disruptions and contextualizing patterns of behavior using commercial data and analytics, the DoD is harnessing readily available data to identify, classify, and attribute adversarial threats, enabling safe navigation of military assets across the globe. This approach is also a cost-saving measure. It eliminates the need to develop, build, and deploy expensive custom hardware, and instead, uses PNT kinematics data that everyday devices generate. This prototype will ultimately allow the DoD to more quickly identify, characterize, assess, and respond to similar events around the globe as the threat of adversarial GPS disruption and manipulation evolves.

Several DoD and civilian agencies are participating, including the National Air and Space Intelligence Center, the National Space Intelligence Center, and the Department of Transportation. Multiple non-traditional vendors and non-governmental organizations are also supporting this effort, by providing data, ML analytics, visualization, and contextualization capability.

Through this partnership, DIU is developing an end-to-end capability that provides situational awareness and assessment of intentional GNSS disruptions in formats that can be broadly shared across the DoD, with other government agencies, and with U.S. allies.

### GIG EAGLE

## Leveraging AI to revolutionize talent discovery within the DoD.

As the DoD adjusts to a more dynamic threat environment, it requires a highly agile, networked, and diverse workforce with specialized talent that is often available only in private industry or academia. With more than 1.1M Reserve and Guard personnel, the DoD has an untapped workforce that can meet this challenge. Currently, however, the talent and expertise embedded in these Reserve components is undiscoverable and, therefore, underutilized.

In June 2021, DIU partnered with U.S. military service components to prototype an on-demand talent optimization platform — GigEagle — that leverages AI/ML methodologies to collect and connect DoD's unique mission needs with available experts in the Guard and Reserve components. GigEagle is specifically geared toward staffing for short-term "gig" projects ranging from a few hours to several months in duration. Many of these projects can be staffed remotely and are difficult to accomplish within the DoD's traditional talent acquisition process.

This platform is being developed in collaboration with leading AI technology companies and is supported by $3M in Congressional funding. Congress appropriated and approved these funds in the FY 2021 National Defense Authorization Act (NDAA) in order to advance the DoD's efforts to modernize its talent acquisition processes. GigEagle will accomplish this objective by delivering a frictionless platform that will identify the right service members to serve in positions that capitalize on their unique skill sets. DIU and the participating commercial partners completed a working version of the prototype in eight months and expect to launch the full-service platform in FY23. The completed platform will ensure that DoD mission needs are efficiently met at a speed and scale that meets the military's challenges of the future. •

National Guard member searching through GigEagle app (Source: Defense Innovation Unit)

[8] Sheetz, Michael, "Bank of America expects the space industry to triple to a $1.4 trillion market within a decade," CNBC, October 4, 2020, https://www.cnbc.com/2020/10/02/why-the-space-industry-may-triple-to-1point4-trillion-by-2030.html

# AUTONOMY

*"Accelerating the adoption and scaling of trusted commercial autonomy and improving our ability to counter adversarial systems."*

### BLUE UAS 2.0
## *Access to a broader variety of highly capable unmanned aerial systems (UAS).*

In partnership with the Office of the Undersecretary of Defense for Acquisition and Sustainment (OUSD(A&S)) and the U.S. Army Corps of Engineers, DIU launched Blue UAS 2.0 in March 2021 to broaden the variety of small UAS (sUAS) available to DoD. As of the end of October 2022, 16 sUAS systems are available on the cleared list, which includes drones that are compliant with Section 848 of the FY 2020 NDAA, validated as cyber secure, safe to fly, and available for government purchase and operation without the need for a DoD exception to policy.

The roots of DIU's Blue UAS program go back to 2018. It was driven by the U.S. Army's Short Range Reconnaissance (SRR) program of record (and collaboration with DIU under the same name) and an increasingly broad set of U.S. government policies banning the procurement of COTS drones manufactured in China. Blue UAS 1.0 offered a modified, standalone, and compliant configuration of the Army's final five SRR UAS to all U.S. government entities. Blue UAS 2.0 marked a deliberate approach to grow the Cleared List and address a wider range of DoD uses from infrastructure inspection, safety functions, mapping, and traditional reconnaissance tasks. Moreover, the growth of the Cleared List improved commercial companies' ability to conduct business with the DoD by standardizing administrative processes that traditionally curbed field adoption.

Blue UAS 2.0 products added to the Cleared List include small quadcopters, fixed wing aircrafts, a coaxial system, and heavy lift options with modular payloads. Drones approved this year include the Ascent AeroSystems Spirit, Freefly Alta X, SenseFly eBee TAC, Inspired Flight 750, Inspired Flight 1200, Blue Halo Intense-Eye V2, Easy Aerial Osprey, Skydio X2D, Harris Aerial H6 and Hydrone, and the Wingtra WingtraOne. Two more systems are close to being

certified for government use. Not only is Blue UAS expanding access to unmanned capabilities across the Federal government, but it is also providing a path into the DoD market for drone manufacturers.

DIU's Blue UAS program and partnership with the U.S. Army continue to build upon each other. The next generation of SRR prototypes leverages multiple components developed under DIU's Blue UAS Framework, which develops compliant sUAS components, including advanced compute flight controllers, mission cameras, data links, and ground control station software. Importantly, the next generation of SRR systems will be fielded along with the Soldier Robotic Controller capable of controlling other Army sUAS and unmanned ground vehicles, which reduces weight, training, and logistical barriers to widespread adoption and operational use of advanced robotic platforms. These efforts will inform industry partnerships for robust standards and Blue UAS 3.0.

### CONSTRUCTION SCALE ADDITIVE MANUFACTURING (CSAM)
## *3D printing for the battlefield and beyond.*

In 2022, DIU partnered with the U.S. Army's Installation Management Command with support from the U.S. Army Engineer Research and Development Center (ERDC) to build 3D-printed barracks at Fort Bliss using ICON's Vulcan construction system. At more than 5,700 square feet each, the new barracks will be the largest 3D-printed structures in the Western Hemisphere and will be the first to comply with the DoD's newly released Unified Facilities Criteria (UFC) for additive concrete construction. This change to UFC by the Structural Discipline Working Group serves to leverage commercial innovation and incorporate novel, time-saving manufacturing methods within the DoD.

Military construction projects at home and abroad are costly, time-consuming, and potentially dangerous in combat zones. Moreover, many DoD structures are not built for a 21st century climate, and aging buildings

**"CURRENTLY, THERE IS A MULTI-BILLION DOLLAR BACKLOG OF HOUSING AND THIS IMPACTS THOSE SERVING OUR COUNTRY. WE ARE PROUD TO COLLABORATE WITH THE U.S. ARMY AND CONTINUE OUR PARTNERSHIP WITH DIU TO SEE DIVERSE USE CASES FOR ICON'S TECHNOLOGY AND TO DELIVER RESILIENT, COMFORTABLE 3D-PRINTED BARRACKS FOR SOLDIERS AT FT. BLISS."**

— BRENDAN O'DONOGHUE, VP OF PUBLIC SECTOR AT ICON



Barrack at Ft. Bliss under construction by Icon in December, 2022 (Source: ICON Technology, Inc. )

are compromised by rot or mildew. Additive concrete construction is providing new building techniques and materials to improve both expeditionary and conventional construction.

Austin-based ICON is leveraging 3D-printing technology to enable durable, faster, and more energy-efficient construction compared to traditional methods. Lavacrete, its proprietary high-strength concrete mix, can be printed at high speeds, is able to withstand extreme weather, and lasts longer than traditional materials. The company first partnered with DIU in 2019 to prototype expeditionary construction capabilities with the U.S. Marine Corps. With only a few hours of field training, a group of eight Marines at Camp Pendleton completed construction of a vehicle hide structure in just 36 hours. ICON recently completed 3D printing the first simulated Mars surface habitat for NASA. Located at Johnson Space Center in Houston, Texas, Mars Dune Alpha will aid in long-duration science missions.

The Fort Bliss barracks are expected to be completed in early 2023, This method of construction is estimated to cost 10-30% less than traditional construction. Third-party studies have also shown that it substantially lowers heating and cooling bills — further reducing total lifecycle costs.

### COUNTER-UAS (C-UAS)

## Counter drone solution for military installations.

In June 2021, DIU finalized a $99M contract with Anduril to make C-UAS available across the DoD and other U.S. agencies. Within 90 days of issuing the contract, three government entities made more than $35M in purchases. In June 2022, after evaluating Anduril's capabilities, the Joint Counter-small UAS Office (JCO) added the company as a recommended provider of installation "C-UAS-as-a-Service" for military services and combatant commanders. Operational use of the "CUAS as-a-Service" model expanded as DIU executed a $4.38M production

"INCLUSION OF THE FREEFLY ALTA X ON DIU'S BLUE UAS 2.0 LIST HAS PROVIDED NEW AND EXISTING CUSTOMERS THE CONFIDENCE THEY DEMAND THAT OUR SYSTEMS ARE SAFE, SECURE, AND RELIABLE. THROUGHOUT THIS PROCESS WE HELPED TO POSITION THE UNITED STATES AS THE GLOBAL LEADER IN THE SUAS INDUSTRY."

— MATT ISENBARGER, CEO, DRONES, FREEFLY SYSTEMS

order to deliver C-UAS technology to Pacific Air Forces (PACAF). PACAF is the first major U.S. Air Force customer to buy off of the Anduril production agreement. Entering the second year of the production agreement, more than $53M in purchases are complete, marking a key step to scale rapidly developed prototypes that are validated through the CSO process. Anduril continues to iterate on improved C-UAS capability to address the pace of this evolving threat.

This expansion and further implementation of the C-UAS Production OT agreement follows a rise of UAS incidents in U.S. Indo-Pacific Command's geographic area of responsibility. Moreover, Russia's offensive use of kamikaze drones against Ukraine is demonstrating the need for defensive systems to counter a variety of UAS threats. Anduril's Lattice AI operating system and sensor network enables the automated detection, identification, tracking, and defeat of objects of interest while reducing manpower requirements.

PACAF will deploy Anduril's autonomous, multi-modal C-UAS capability to two installations for a 12-month period. This effort enables C-UAS technology testing in the extremes of tropical and cold-weather environments. Additionally, the deployment includes the first implementation of the Anvil Interceptor — a kinetic defeat option — to support protection of key installations and infrastructure. ●



Cyberwarfare specialists serving with the 175th Cyberspace Operations Group of the Maryland Air National Guard (Source: 108th Wing)

# CYBER & TELECOM

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.

### CYBER THREAT TELEMETRY

## Delivering an asymmetric view of the cyber threat landscape.

In today's fragmented digital battlefield, governments often leverage non-state proxies to conduct cyber attacks. Historically, DoD has lacked visibility into such threat actor activity from both commercial telemetry data and non-traditional cyber data sources.

Since 2019, USCYBERCOM, CNMF, and the service cyber components have partnered with DIU to develop a solution that would augment existing threat intelligence feeds with new commercial data. In FY 2022, DIU and partners amplified this relationship with the execution of a prototype contract with four commercial vendors, CA Services/Broadcom, Dragos, Scylla Intelligence, and SpyCloud. These companies are currently developing technical prototypes that include traditional threat intelligence platforms, internet of things monitoring services, and industrial control systems/operational technology monitoring services.

Cyber warfare: The silent hunt
(Source: DVIDS)

"BASTILLE NETWORKS IS PROUD TO BE PROTECTING DOD CLASSIFIED ENVIRONMENTS FROM WIRELESS DEVICE AND NETWORK THREATS AS PART OF THE SPECTRUM AND WIRELESS MONITORING SYSTEM (SWIM) PROGRAM. THE DIU PROCESS WAS VERY EFFICIENT AND IS A MODEL OF HOW THE U.S. GOVERNMENT CAN PARTNER WITH VC-BACKED TECHNOLOGY COMPANIES TO LEVERAGE PRIVATE INVESTMENT IN THE DELIVERY OF INNOVATIVE NEW SOLUTIONS."

— IVAN O'SULLIVAN, CRO, BASTILLE NETWORKS INC.

Building on a trusted relationship between DIU, USCYBERCOM, and CNMF, these projects supplement ongoing efforts with commercial threat intelligence and telemetry providers.

With this growing suite of solutions, DoD is now able to gain previously unavailable context into cyber attacks against critical infrastructure while also prioritizing responses in a more efficient manner.

**SPECTRUM & WIRELESS MONITORING (SWiM)**

## Identifying and defending against malicious wireless signals.

The use of cell phones and connected devices is ubiquitous in daily life. While this has afforded individuals significant convenience, every connected device becomes a vulnerable node that is subject to attack from malicious adversaries looking to obtain access to sensitive and classified information.

Miniature-sized or embedded rogue wireless devices may be introduced into government facilities passing through security checkpoints, especially when they are not activated at t ime of entry.

Given the risk of wireless intrusions and electronic eavesdropping of sensitive information, an intelligence community partner sought the help of DIU to procure, prototype, and ultimately transition a locally managed COTS sensor network assembled on a modular, open, non-proprietary platform. The partner was eager to identify a next-generation wireless intrusion detection solution that could be leveraged for continued protection against radio frequency (RF) spectrum threats.

In September 2021, DIU selected two commercial vendors to:

1  prototype a solution that will identify rogue wireless signals created by the ubiquitous use of wireless devices operating across the RF spectrum;

2  defend against both unintended and malicious RF emanations; and

3  develop a future-proof architecture that can adapt to the rapidly changing landscape of RF signals. This solution can be deployed across the entire defense ecosystem as an enduring force protection requirement.

This effort highlights scaling across the U.S. government by partnering with an intelligence agency. Throughout FY 2022, the DIU Cyber & Telecommunications Portfolio and partners delved into the prototyping stage while enhancing DIU's ongoing relationship with the National Security Agency and the intelligence community.

**CRYPTOCURRENCY ANALYSIS & ATTRIBUTION**

## Disrupting illicit & adversarial cryptocurrency transactions.

In today's digitized world, nearly every aspect of commercial and political statecraft is vulnerable to disruption, theft, or manipulation. The emergence of cryptocurrencies, in particular, is making it easier to monetize breaches in network security. Though cryptocurrency can be used for legitimate purposes, the overall lack of visibility into the ownership of cryptocurrency wallets and their associated transactions has engendered a new wave of cybercrime that includes cases of ransomware, money-laundering, and concealment of financial assets. In 2021, more than $400M of cryptocurrency payments went to groups "highly likely to be affiliated with Russia."

To address this rising national security threat, USCYBERCOM partnered with DIU to prototype a solution that is capable of tracing cryptocurrency wallets to individuals and illuminating illicit networks using transaction data, specifically for actions targeted against U.S. government and military interests.

While the United States has passed know-your-customer provisions for cryptocurrency and sanctioned Russian exchanges, USCYBERCOM has identified a need for private sector resources to access and monitor the currency exchange to quickly shut down malicious cyber actors and their activities.

In June 2022, DIU and CNMF awarded prototype OTs to three commercial vendors, CipherTrace, Coinbase, and TRM Labs. These vendors are currently developing a platform that will help the task force teams under the CNMF Command headquarters identify cryptocurrency assets and thwart illicit transactions related to adversarial activities. As other federal agencies ramp up their efforts to regulate the crypto space, DIU looks to collaborate with financial regulators, law enforcement, and private entities to help track and reclaim cryptocurrency that funds criminal activity. ●

# ENERGY

**Strengthen resilience on military installations and enhance operational energy capabilities.**

**"WITH DIU'S HELP, WE ARE ENGAGING INDUSTRY TO UTILIZE COMMERCIAL BUILDING BLOCK BATTERIES THAT CAN BE DEPLOYED AS THE FOUNDATIONAL PATHWAY FOR THE HYBRIDIZATION OF ANY GROUND VEHICLE PLATFORM … LEARNING HOW TO PACKAGE AND INTEGRATE COMMERCIAL TECHNOLOGY INTO NON-PROPRIETARY DEFENSE INTERFACES AND PLATFORMS."**

— DAPHNE FUENTEVILLA, DEPUTY DIRECTOR OF THE DEPARTMENT OF THE NAVY OPERATIONAL ENERGY PROGRAM

### ELECTRIC VEHICLE SUPPORT EQUIPMENT (EVSE)

*Scaling EV rapid charging infrastructure across the force.*

As electric vehicle (EV) usage expands, so too does the need for more EV charging stations. In particular, the DoD will soon require charging stations that can support both Government Owned Vehicles (GOVs) and Personally Owned Vehicles (POVs) across its 450+ domestic military bases. Currently, charging stations located on domestic military bases are designated for GOVs only, limiting the ability of service members to leverage the potential advantages of EVs in their personal and professional lives.

Under DIU's EVSE program, TechFlow and other vendors are partnering with each of the Services to pilot Level-2 and Level-3 car chargers at select bases. Once the on-base charger installation phase is complete, DIU will run a year-long analysis to measure charger usage, uptime, vehicle type (i.e., POV vs GOV), wait time, and mean time to repair, while validating these chargers' capabilities against federal cybersecurity standards. The project will also evaluate the viability of charging-as-a-service payment models, wherein POV charging revenues defray DoD EV infrastructure investments.

Early Blended Wing Body concept design for NASA (Source: NASA)

The prototype will obtain FedRAMP certification for the Level-2 and Level-3 chargers to ensure adherence to DoD cybersecurity protocols.

This is the first DoD EV charger project targeting both GOVs and POVs. With an increasing number of EVs on the road, both operational as well as personal, a variety of charging solutions are needed to meet this growing demand in order to enhance installation resiliency and reliability.

Following successful installation, this pilot will enable all federal agencies to shift into production scale adoption of EV charging stations, enabling broader access to EVs.

### JUMPSTART FOR ADVANCED BATTERY STANDARDIZATION (JABS)

*Accelerating DoD's battery standardization and adoption.*

The military requires thousands of unique types of batteries each year because it operates a wide variety of systems that each use specific batteries. This results in hundreds of millions of dollars in annual battery procurements at a cost point up to 10x above the market standard.

Fortunately, recent technological advancements driven by large commercial investments in the EV sector have yielded advanced batteries characterized by substantially improved performance at a lower cost. The DoD aims to improve the capability of a multitude of current systems

by adopting cutting-edge commercial EV battery technologies for military use. Examples of DoD applications for which advanced batteries provide potentially transformational advantage include electrifying vehicle fleets (silent watch, silent mobility, future contested logistics challenges, etc.), improving energy storage (installation resilience, reduced logistics burden, etc.), and powering advanced capabilities (directed energy, edge computation, etc.).

DIU is partnering with OUSD(A&S), the U.S. Army's Combat Capabilities Development Command (DEVCOM), Ground Vehicle Systems Center (GVSC), Naval Sea Systems Command Crane Division, and the Department of the Navy Operational Energy to accelerate battery standardization and production advancement within the DoD. Coordinated efforts across the DoD will align battery requirements to commercial EV battery standards and provide a contracting path to acquire compliant commercial batteries at scale.

In September 2022, OUSD(A&S) and DIU issued an award to GM Defense to develop a battery pack prototype for testing and analysis on DoD platforms. The company is leveraging

the latest commercial battery technology of its parent company, General Motors, to deliver a scalable design that can be used for tactical military vehicles and inform a standard integration pathway for similar technology. Additional prototype contracts will be awarded in 2023.

The JABS project is a critical first step required to keep pace with technology advancements as the military begins electrifying vehicle fleets and platforms. This is the first OSD and inclusive joint project allowing commercial EV battery manufacturers to test and develop standards required to adapt batteries for broad DoD applications. The joint nature of this project streamlines the timeline required to scale and field the capability, while simultaneously exposing end-users across the Services to the possibilities enabled by cutting-edge commercial batteries. Critically, supporting the development of a standardized set of battery modules will increase DoD's demand signal for commercial batteries, reduce barriers for the commercial sector to work with the DoD, and pave the way for future battery advancements to be seamlessly integrated and adopted within military platforms.

### BLENDED WING BODY

## *Optimizing cargo and tanker operations for the DoD.*

For decades, the commercial aviation marketplace has been making innovative advancements to reduce aircraft fuel usage and carbon footprints. A particularly noteworthy outcome of commercial R&D is the Blended Wing Body (BWB) airframe. BWB aircraft would have a more streamlined design than traditional tube-and-wing aircraft, significantly improving aerodynamic efficiency, resulting in a fuel-savings of 40% or more.

Despite proven technologies and early designs dating back to the 1990s,

adopting a new airframe is risk-prohibitive for market leaders. DIU's effort, on behalf of the Air Force, is designed to de-risk development of this game-changing platform.

In recent years, the DoD — especially the Air Force — has taken a deeper interest in the BWB airframe as a potential solution for scenarios that cover long distances in fuel-constrained environments, such as the Pacific theater. By maximizing operational fuel efficiency via adoption of a successful BWB design, the DoD will increase platform range, decrease operational costs, mitigate burdensome logistics requirements, and simultaneously reduce the U.S. military's impact on climate change.

In support of these objectives, the Air Force Operational Energy Office (SAF/IEN) partnered with DIU, NASA, and commercial industry, to prototype a concept of design (CoD) for an advanced aircraft configuration that provides at least 30% more aerodynamic efficiency compared to traditional aircraft models. DIU issued a solicitation for commercial BWB CoD solutions in July 2022 and is currently in the process of competitively down-selecting prospective vendors for this concept of design effort.

A move to the BWB design can be utilized for cargo, tanker, and bomber aircraft, which together account for approximately 60% of the Air Force's total annual jet fuel consumption (approximately 1.2B gallons per year). SAF/IEN estimates that transitioning to BWB aircraft across these fleets would result in an annual fuel savings of $1B per year with current year fuel price and flying hours. •



PercuSense device on active duty soldier (Source: Defense Innovation Unit)

> **"THE EXPERTISE AND SUPPORT PROVIDED BY THE COLLABORATION BETWEEN DIU AND DTRA HAS HELPED ACCELERATE THE TECHNOLOGY DEVELOPMENT AND ALLOW ADAPTATION OF PERCUSENSE'S BIOSENSING TECHNOLOGY PLATFORM TO DRIVE THE EARLY DETECTION OF CHEMICAL EXPOSURE FOR WARFIGHTERS AND FIRST RESPONDERS."**
>
> — BRIAN KANNARD, CEO, PERCUSENSE

# HUMAN SYSTEMS

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

### DETECTING INDICATORS OF CHEMICAL EXPOSURE (DICE)

## *Wearables to detect exposure to chemical warfare agents.*

Military service members are at risk for inadvertent contact with chemical warfare agents. Exposure presents a similar concern to civilian and military first responder communities who may be required to enter environments where similar hazards are present. In many cases, symptoms of chemical toxicity are not noticeable until it's too late. To address this, DIU and the Defense Threat Reduction Agency (DTRA) launched the Detecting Indicators of Chemical Exposure (DICE) program in 2020 and are currently prototyping chemical detection solutions through Philips Healthcare and PercuSense.

PercuSense's DICE biosensor prototype builds off of existing COTS wearable devices for continuous glucose monitoring (CGM) in diabetes patients. Specifically, the prototype is adapting CGM wearables to detect chemical agents by unobtrusively monitoring vital signs and relevant biomarkers associated with exposure to opioids and other chemical warfare agents. Users receive real-time feedback on chemical changes occurring with alerts delivered for exposure to unsafe levels of toxic chemicals. By improving short-term risk management and reducing the chances of long-term physiological impact of chemical exposure (e.g., cancer), the DICE system will save lives, money, and minimize the threat of chemical incapacitation to military service members and civilians alike.

The prototype device is built with the capability of measuring three distinct, validated biomarkers that have passed compatibility tests. The multi-biomarker sensing capability enables scalability to other molecules (e.g., physical exertion, heat injury, neurological conditions, etc), lending itself to the dual-use market and other DoD use-cases.

"**WE ASSESS THE USE OF THE FABRIC CHASSIS, WHICH SIGNIFICANTLY IMPROVES THE PERFORMANCE OF THE TEAM'S ACTIVITIES BY INCORPORATING ALL THE COMMUNICATION ACCESSORIES FOR THE MOLAR MIC INTO ONE SIMPLE CONCEALED GARMENT.**"

— USAF CI COMMANDER

A recent additional investment from DTRA will enable first-in-human testing followed by usability and operational testing with DoD cohorts undergoing field exercises. As the project approaches its final stages in the summer of 2023, the DTRA and DIU teams will look to transition the PercuSense DICE device to the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRN) for fielding and manufacturing.

**WIRELESS COMMUNICATION**

## Transforming communication devices across the DoD.

Communication is essential for conducting military operations. This year, DIU launched two projects with two DoD partners to transform the way the DoD employs tactical communications for use with intelligence teams and USCG vehicles.

Foreign Intelligence Entities (FIE) have increasingly sophisticated sets of capabilities to detect and disrupt U.S. intelligence activities. In response, a Military Department Counterintelligence Organization (MDCO) approached DIU for a wireless and hands-free communication solution. It is imperative that the communication posture they employ is physically undetectable or they risk exposure and jeopardize the mission.

In November 2021, DIU selected one vendor to prototype a solution that combines two novel capabilities. The first capability is an e-textile material with embedded micro electronics which enables power and data to be pushed discreetly through clothing. The second capability is a transmitter/receiver with a microphone that fits inside the mouth and enables non-visible two-way communication through bone conduction. The initial prototype was delivered in April 2022, and by June, the Air Force Counterintelligence team was using it in the field. Due to its success, other Service elements are also testing the technology.

With USCG, DIU focused on wireless communication to vehicular mission sets, enabling multiple crewmen to utilize multiple vehicle mounted radios in varying environments (maritime, land, and air). The initial use case currently being prototyped for the USCG will enable upwards of 10 crew members to communicate with up to five radios without hardwire connections. Within 86 days of soliciting industry, DIU was able to get non-traditional wireless communication vendors on contract, demonstrating the speed at which DIU bridges the gap between industry and the government. This also paved the path for the Coast Guard's first ever use of its newly authorized OT authority to rapidly acquire and adapt new technologies.

**REAL-TIME INFORMATION & EFFECTS (RIE)**

## Making use of large information environments.

Some of the most mission-relevant data exists behind firewalls. Real-time understanding of adversary information environments has become mission critical across the DoD. The challenge is twofold: access and scale. The scale of what flows in these information environments is measured in petabytes. As such, knowing what information to collect and how to process it is key.

RIE is a DIU program to test and prototype commercial capabilities for understanding and mapping foreign information environments. In July 2021, Vannevar Labs was awarded as the lead technology partner to deliver against this mission area. Since then, the effort has grown to support 20+ organizations and more than 100 users across multiple Services and Combatant Commands. This will enable rapid acquisition of software and prototyping efforts, advancing DoD tactical, operational, and strategic objectives within the information environment. ●

An Avalanche Energy scientist works to assemble the fusion reactor core 'Neo', the first of several planned iterations that utilizes a unique electrostatic plasma confinement technique called an 'Orbitron' (Source: Avalanche Energy Designs)

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.

# SPACE

**HYBRID SPACE ARCHITECTURE (HSA)**

## Scalable, resilient, and responsive communications infrastructure.

Legacy ground and space communications systems rely on old technology, inefficient bandwidth allocations, as well as bespoke or proprietary data architectures. Altogether, these attributes inhibit true communications resiliency. DIU's HSA program seeks to address this by providing global, ubiquitous, and secure internet connectivity throughout the space domain for commercial, civil, and military users, including allies and partners.

DIU is collaborating with the U.S. Space Force's Space Warfighting Analysis Center and the Air Force Research Laboratory's Space Vehicles Directorate on this prototype effort.

In May and September of 2022, DoD awarded a total of eight agreements to a diverse set of companies which, collectively, are pursuing the goals of an agile and resilient communications architecture. Through the HSA program, these companies will demonstrate a network architecture that leverages both commercial and government space assets across diverse orbits to provide secure, assured, and low-latency data communications anywhere on and off Earth.

### HYPERSONIC & HIGH-CADENCE AIRBORNE TESTING CAPABILITIES (HyCAT)

## Low-cost, high-cadence, long endurance testing of hypersonic systems.

The DoD's ability to test hypersonic technologies is limited. Current land and sea-based test ranges are optimized for low-cadence and operationally representative tests that replicate the trajectory and velocity of the hypersonic weapon system. However, these test ranges are severely limited in their ability to rapidly iterate and advance state-of-the-art hypersonic technology. The resulting slow pace of hypersonic research and development has significantly impacted the DoD's ability to mature this technology and remain competitive against adversaries.

In response to this challenge, DIU will prototype a suite of modern, low-cost, high-cadence airborne testing platforms (vehicles) that allows for rapid, inexpensive, and long endurance testing of hypersonic systems and their components. The data and analyses resulting from these prototype tests will accelerate the evaluation of potential weapon system concepts, technologies, and mission sets.

In September 2022, DIU issued its first hypersonics solicitation in partnership with the OUSD(R&E) Director of Hypersonics and the Test Resource Management Center. While vendor selection for this effort is ongoing as of the time of this report's publication, it is included here to emphasize the significance of this project to the area of hypersonics.

### NUCLEAR ADVANCED POWER & PROPULSION (NAPP)

## High-power and high-energy density fuels to enable future DoD missions.

Current spacecraft propulsion systems — whether powered by chemical or solar energy — will not meet requirements of future DoD space operations. More recent DoD space missions are focusing heavily on disaggregated clusters of small satellites. Nuclear propulsion and power solutions are well-suited to these types of missions as they are able to move large masses at interplanetary distances. In response to this need, DIU initiated the NAPP project to prototype nuclear decay and fusion propulsion solutions for small and medium satellites.

Current estimates indicate that the U.S. is five years away from achieving a demonstrable fission propulsion capability, and 10 years away from achieving fusion propulsion applications in space. The NAPP program accelerates that timeline by leveraging commercial innovation and investment in accordance with U.S. space policy.

The project is beginning with laboratory-based prototype testing of nuclear power systems, which can provide power for electric propulsion and on-station power for sensing and communication. Early efforts have focused on a systems-level feasibility analysis, forging new regulatory and licensing pathways, and laying the groundwork for commercial nuclear material supply chain strength and resilience. The NAPP program aims to support a commercial prototype demonstration launch of a high power density radionuclide decay system by 2025. ●

Secretary of Defense Ash Carter speaks with Defense Innovation Unit Experimental employees on May 11, 2016 (Source: DVIDS)

THIS EDITION OF DIU'S ANNUAL REPORT IS DEDICATED TO FORMER SECRETARY OF DEFENSE, ASH CARTER.

FOR YOUR FORESIGHT, YOUR VISION, AND YOUR COMMITMENT TO BUILDING A SAFER WORLD FOR ALL.

"I founded DIU [the Defense Innovation Unit] for the following reason: We need to continue to be the finest fighting force the world has ever known. In a technological world, the only way we can continue to be the best is to use technology better than any other military on Earth. Because so much of today's technology base — it resides in the commercial sector and in new and emerging companies ... The idea was to be one of several — but one of the very important — bridges that we needed to create in this era in the same way that we created DARPA [Defense Advanced Research Projects Agency], NASA [National Aeronautics and Space Administration], and the NRO [National Reconnaissance Office] and other great institutions in the aftermath of Sputnik in the 1950s. Faced with a similar challenge, we need to have a similar burst of institutions, which represent the link between the Department of Defense and the tech sector."

— ASH CARTER, FORMER SECRETARY OF DEFENSE, JUNE 2022

# DEFENSE INNOVATION UNIT

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