ADVANCING COMMERCIAL TECHNOLOGY
FOR NATIONAL SECURITY

DIU Overview for SAME

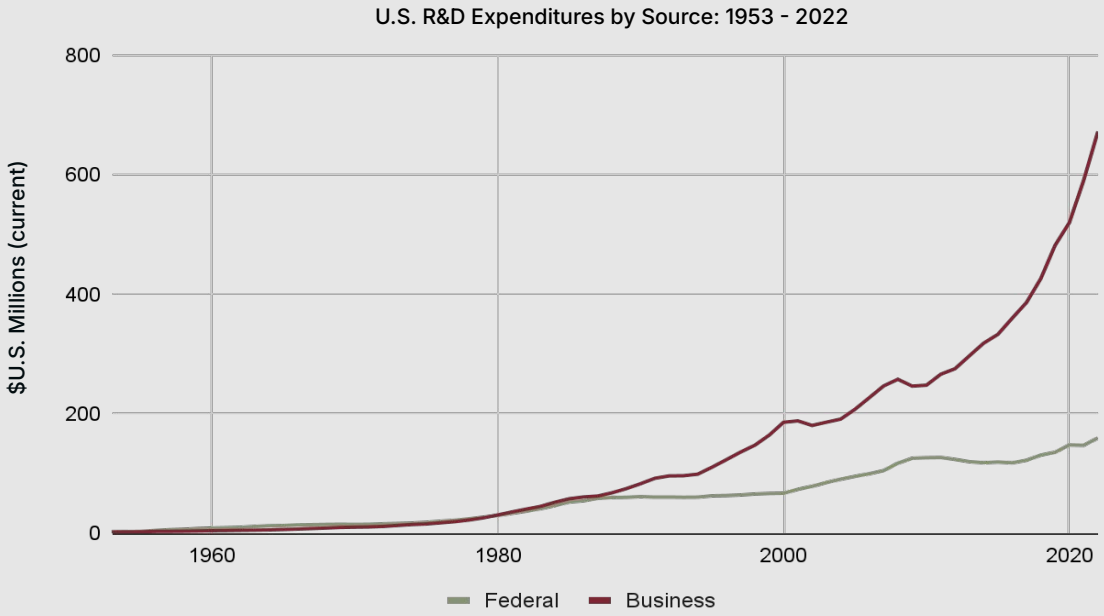
CAPT McKissick
Maritime Portfolio Director
Defense Innovation Unit (DIU)
U.S. Department of Defense

DEFENSE
INNOVATION UNIT

The Defense Innovation Unit accelerates the Department of Defense's adoption of commercial technology at speed and scale in order to deter major conflict or win, if forced to fight.

DEFENSE INNOVATION UNIT

DoD must capitalize on private R&D



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DIU's business model

Most important DoD problems

Department of Defense

DIU provides...

- Access to leading commercial technology
- Collaborative prototype process
- Delivery of capabilities in 12-24 months
- Solutions at commercial cost curves

DIU facilitates projects between our DoD partners and commercial companies to prototype, transition, and scale advanced technology.

Qualified DoD vendors

Commercial Companies

DIU provides...

- Opportunity to solve high-impact national security problems
- Simple process and faster time to award
- Access to large volume defense contracts
- Liaison with DoD partner

DEFENSE INNOVATION UNIT

From experiment to outsized impact

DIU 1.0
BUILDING THE BRIDGE

2015 - 2018

Establish communications between DoD and the technology sector.

DIU 2.0
PROVING OUR MODEL

2019 - 2022

Build upon relationships established under DIU 1.0 to hone our process for prototyping and transitioning dual-use solutions.

DIU 3.0
DELIVERING STRATEGIC IMPACT

2023 - onward

Leverage commercial technology with the focus, speed, and scale necessary to deter major conflict and win, if forced to fight.

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DIU Portfolios At-A-Glance

AI/ML

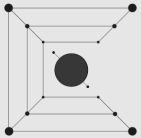
49 Awards
$144.6M

Autonomy

142 Awards
$452.0M

Cyber & Telecommunications

67 Awards
$112.9M



Emerging Technology

New Portfolio

Energy

51 Awards
$200.0M

Human Systems

69 Awards
$320.3M

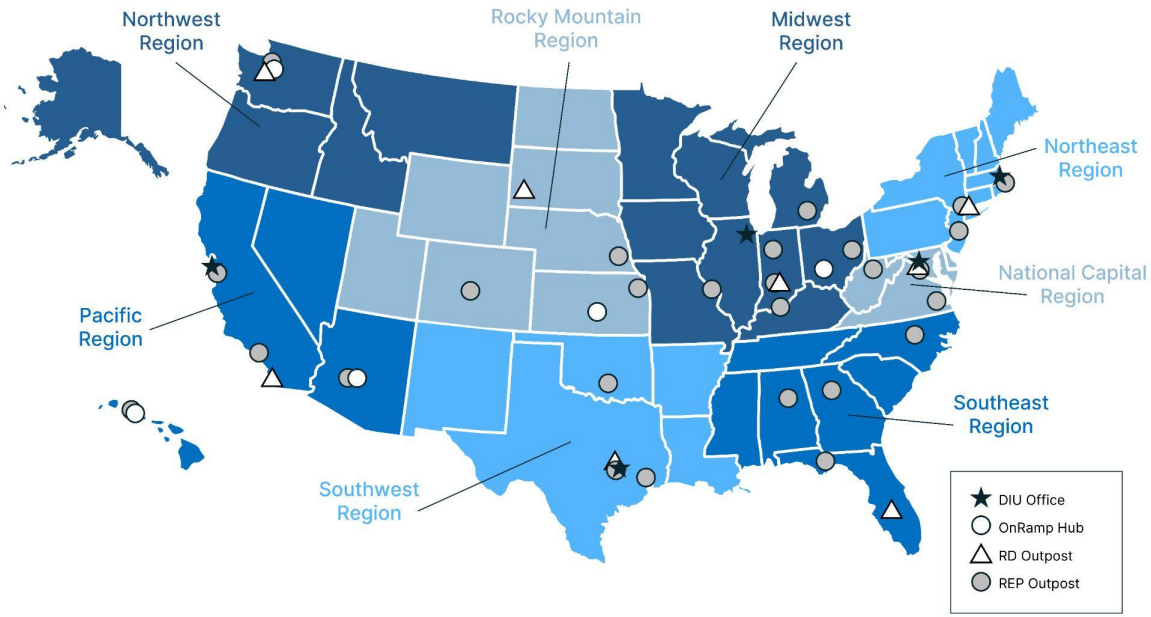
Space

72 Awards
$440.1M

450 Prototype OT Awards at $1.7B

Data period: June 1, 2016 - September 30, 2023

Regional Points of Presence



Physical presence is an asset for early-stage support.

Regions

- 8 Regions, supported by 30+ externally oriented representatives across the country
- 5 OnRamp Hubs acting as physical front doors

Universities

- Engaged 85 universities

Companies

- Received solicitations from all 50 states
- Issued awards in 37 states + DC

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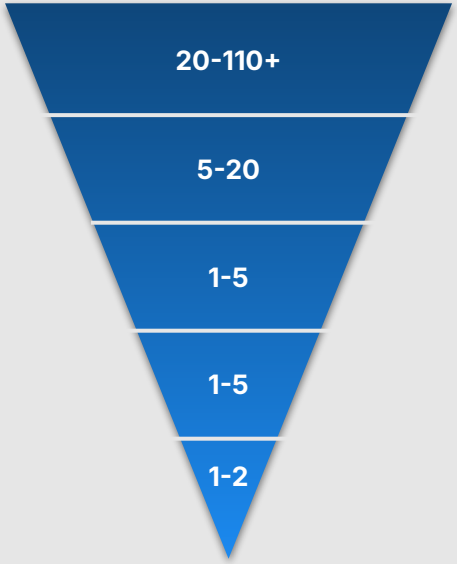
Unique project lifecycle - fast & competitive

Problem Curation & Diligence		• Receive, understand, and evaluate DoD partner problem • Confirm commercial market exists to address problem	No Requirements
Commercial Solutions Opening (CSO)	**Phase 1**	• Solicit digital proposals in response to a problem statement	~10 business days
	Phase 2	• Evaluate proposals and invite a short list of bidders to pitch	60-90 days to contract award (goal)
	Phase 3	• Select contract awardee/s and negotiate agreement	
Prototyping		• Execute prototype project	12-36 months
Transition		• Award non-competitive agreement to successful performers • Deliver & scale solution to transition partner/s	No Recompete FAR Not Req'd

Approximate Number of Vendors Participating



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Energy resilience is military readiness

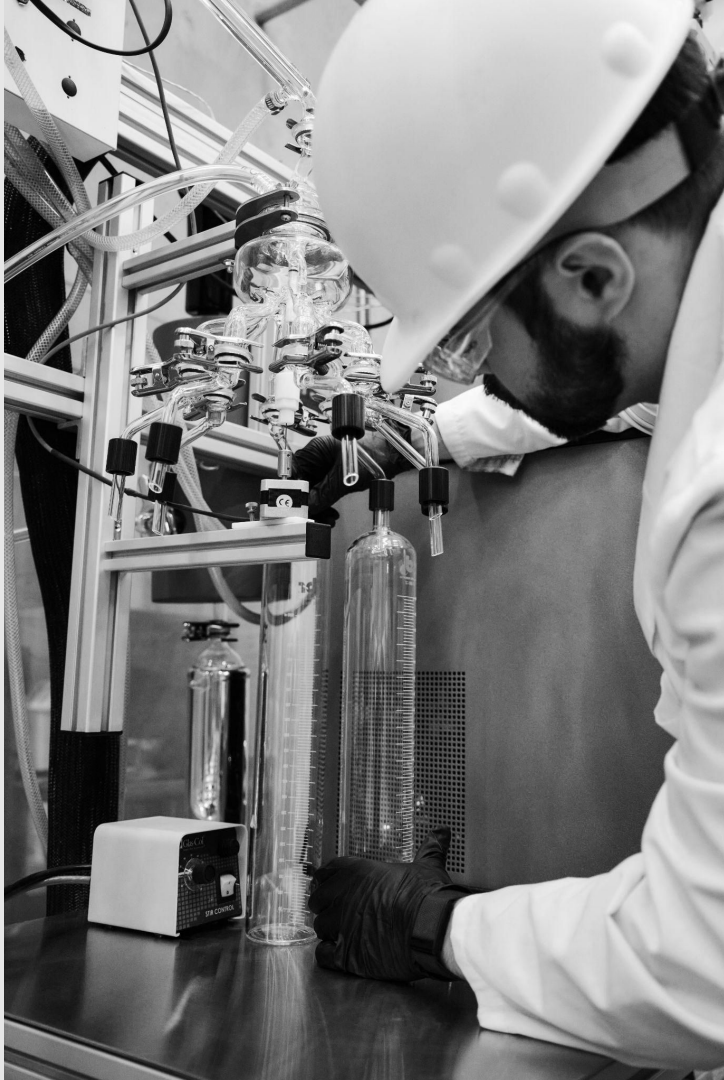
The DoD consumes **77% of the entire federal government's energy**. Our systems are designed for an environment where fuel supply lines are unchallenged. In an contested future fight, energy and logistics will be a domain of warfare unlike any in the post-WWII era.

Improvements to operational and installation energy are necessary to:

- Transform the foundation of the future force
- Make the right technology investments
- Adapt and fortify our defense ecosystem
- Strengthen resilience and adaptability

"For the United States to be effective in the Pacific, we already have a significant logistics challenge, worsened by the reliance we have on fuel.

Dr. Kathleen Hicks, Deputy Secretary of Defense



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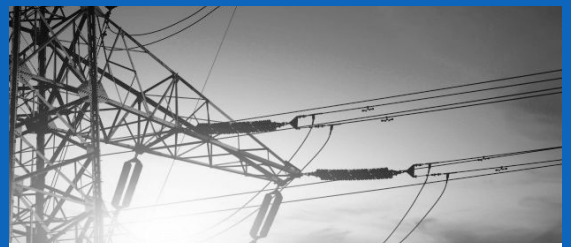
Energy portfolio lines of effort

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



Installation Resilience & Infrastructure

Ensuring resilient and efficient installations by optimizing energy generation, storage, and delivery while ensuring smart, secure, and efficient installations.

Operational Energy

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

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Highlighted Projects For The Navy

(Source: DVIDS)

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Problem Curation | Diligence | CSO Process | Prototyping | Transition

EXPEDITIONARY HYDROGEN ON SHIP & SHORE

Expeditionary Hydrogen On Ship & Shore

Problem

Fuel supply chains are vulnerable to disruption and an alternative fuel is necessary to sustain operational capabilities and improve energy resilience as well as to untether from existing logistics supply chains.

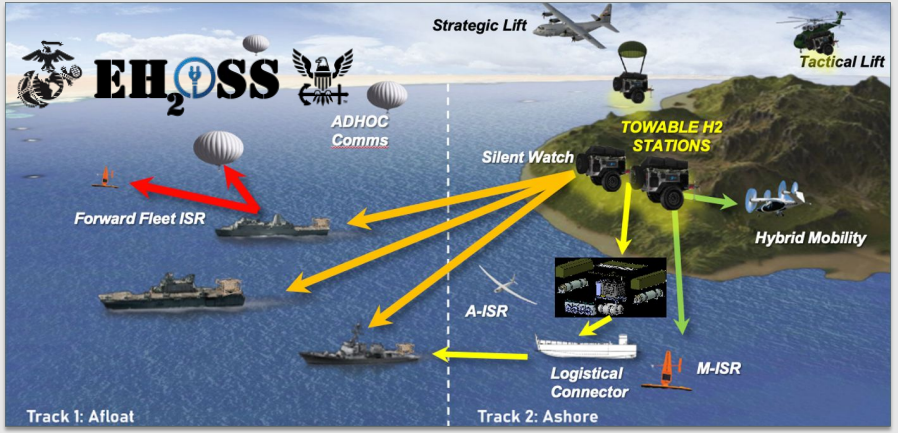
Solution

- A solution that operates both aboard ship and ashore that through electrolysis can generate, store and distribute hydrogen to a family of fuel cell platforms and create a “micro hydrogen supply chain” at the tactical edge
- Capacity to produce and dispense 20kg of 350 bar H2 in 24 hours
- DIU CSO to overcome first-mover dilemma in the hydrogen supply chain.

Impact

- Increased ability to operate in austere, remote locations - EHOSS system can produce hydrogen at the point of use, enabling mobile and disaggregated stand-in forces to persist.
- Enables warfighters to leverage operational advantages of extended range and lower electronic signatures with fuel cells
- 10kg of H2 can support up to 360 hours of H2 Stalker flight and up to ~1400 miles of H2 ULTV operation.

DIU PM, Andrew Mawdsley



DoD Partners	Commercial Vendor(s)
• INDOPACOM • USMC - Expeditionary Energy Office • USN - Naval Information Warfare Center Pacific • USN - Naval Research Laboratory • USA - Ground Vehicle Systems Center	• TBD

DEFENSE INNOVATION UNIT

Problem Curation | Diligence | CSO Process | Prototyping | Transition

ENVIRONMENTAL REMEDIATION & RESTORATION FROM PFAS

Treating PFAS-impacted solids and groundwater on DoD Installations

Problem

Hundreds of DoD installations are saturated with per- and polyfluoroalkyl substances (PFAS) from ~50 years of using Aqueous film-forming foam (AFFF) to suppress fires. The concentration of these long-lived chemicals presents health risks to military members and the surrounding community. The DoD's resulting liability is estimated at over $2B.

Solution

- Scalable PFAS treatment process that can be done on-site and permits unrestricted disposal and discharge
- PFAS destruction or filtration processes that are capable of fully mineralizing chemicals impacting soil, sediment, and groundwater

Impact

- Removal of potentially hazardous substances tied to birth defects, diabetes, and multiple forms of cancer
- Reduction in the substantial ongoing liability facing the DoD

DIU PM, Lara Azzam

DoD Partner(s)	Commercial Vendor(s)
• Environment & Environmental Restoration • Strategic Environmental Research & Development Program & Environmental Security Technology Certification Program • Navy Facilities Engineering Systems • Air Force Civil Engineering Center • Acquisition & Sustainment	• Allonnia • Aquagga • Arcadis • ASRC • Battelle • Cyclopure • ECT2 • General Atomics • Savron • TRS

DEFENSE INNOVATION UNIT

Problem Curation | Diligence | CSO Process | **Prototyping** | Transition

Extended Duration Storage for Installations (EDSI)

Addressing intersecting installation and operational energy need for resiliency

Problem

The DoD needs access to secure, cost effective, and reliable energy that's resilient to natural and man-made disruptions to support critical loads for days or weeks.

Solution

- Leverage emerging breakthroughs within long duration energy storage (technology, chemistry agnostic) spanning Mechanical (compressed air, gravity-based, pumped hydro), Electro-mechanical (flow batteries), and Lithium (Chemical-thermal)

Impact

- Buy down risk to accelerate the adoption of Long Duration Storage
- Improve installation energy resilience, enhance grid security and containerize power for operation energy applications
- Enable net-zero carbon electricity system

DoD Partner(s)	Commercial Vendor(s)
• Marine Corps • AFRL / SAFIE • Agility Prime • Next Step • OSDI&E / OE-I • DOE–OCED/NREL • ARPA-E • OSD–ESTCP/SERDP	• CellCube – Stationary Grid Scale • Redflow – Stationary Microgrid • Dannar – Distribution class self-propelled for Grid and Operational Energy Applications

DIU PM, Justin Martin

DEFENSE INNOVATION UNIT

Problem Curation | Diligence | **CSO Process** | Prototyping | Transition

Advanced Nuclear Power for Installations

Advanced Nuclear Reactors for clean, sustainable, and decentralized power

Problem

The DoD - and allied nations - are reliant on a power grid vulnerable to supply shocks (oil) or power outages from natural and manmade disasters.

Solution

- To leverage the private sector, on the cusp of a nuclear renaissance, led by energy demands and technology advancements
- Multi-phased prototype to provide decentralized power for installation resilience ranging from 1 megawatt (MW) - 10 MW
- Will support the restart of the Army nuclear regulatory program

Impact

- Enables force projection and energy resiliency for our most critical bases
- Future scaling opportunities throughout the U.S. and military operational areas.
- The bridge to deployable nuclear power

DIU PMs: Justin Martin, Sujata Millick

Rendering of MARVEL Microreactor

Idaho National Laboratory

Idaho National Laboratory MARVEL Microreactor Core *

* Pictures are a representation of an ongoing DOE microreactor effort.

DoD Partners	Commercial Vendor(s)
• ASA (IE&E) • JSOC / SOCOM • AMC • Army Reactor Office • SAF/IE*	• TBD

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Installation Energy Projects

Ensuring resilient and efficient installations by optimizing energy generation, storage, and delivery while ensuring smart, secure, and efficient installations.

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Problem Curation | Diligence | CSO Process | Prototyping | Transition

Net Zero Buildings
Energy Resilience and Sustainability

Modernization of DOD construction and renovation practices to reduce energy demand, carbon emissions, and long term costs

Problem

The DoD accounts for 80% of USG's energy consumption which is used by over 238,000 buildings located on 500 DoD installations worldwide. Much of this energy usage is avoidable through Net Zero technologies.

Solution

- Test and evaluate three different building prototypes: 2 new Child Development Centers (CDC) and 1 retrofit of existing barracks
- Integrate modern Net Zero technologies into design & construction
- Optimize passive performance of buildings from ambient energy sources (e.g. solar, geothermal, etc.) to realize efficiency gains
- Implement full electrification of standard building operations
- Incorporate sustainable materials and products to minimize Global Warming Potential (GWP)

Impact

- Achieve at least 30% energy reduction per ASHRAE 90.1 (2022) baseline
- Achieve net zero emissions (for greenhouse gas Scope 1 emissions)
- Provide expedited route to military construction and/or renovation
- Teach services how to use OTAs for new construction and renovation
- Establishes new and/or updated building performance standards

DIU PMs, Sam Valencia & Andrew Ferguson

DoD Partner(s)

- Asst Sect of the Army for Installations, Energy and Environment
- Asst Sect of the Air Force for Energy, Installations, and Environment
- Naval Facilities Engineering Systems Command
- U. S. Army Corps of Engineers
- Air Force Civil Engineer Center
- National Renewable Energy

Commercial Vendor(s)

- Vendors (TBD)
- Navy and Air Force - Military Construction (MILCON) prototype:
  -Phase 3 Kickoff completed on 25 April 24
  -USAF Site- Hanscom AFB, MA.
  -USN Site- JEB Little Creek, VA.
- U.S. Army Project Renovation (RENO) prototype
  -Phase 3 Kickoff completed on 03 June 24
  -USA site - Ft. Campbell, KY.

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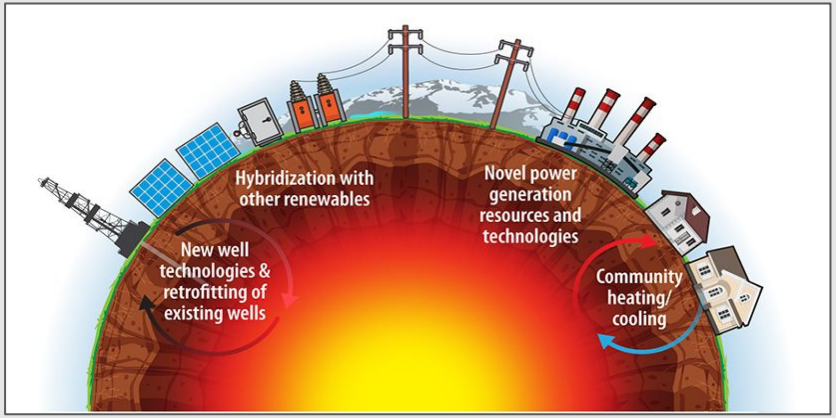
Geothermal

Deploy advanced geothermal technologies to provide resilient and renewable 24/7 energy to DoD installations worldwide.

Problem Curation | Diligence | CSO Process | Prototyping | Transition



Problem

DoD installations are vulnerable to both malign actions and extreme weather events that could interrupt energy powering critical missions

.

Solution

Deploy a variety of advanced geothermal technologies throughout a wide variety of geology and thermal heat conditions to deliver clean, resilient energy that is available 24/7 regardless of weather conditions or grid availability.

Impact

- Improve DoD installation energy resilience through 24/7 delivery.
- Insulate DoD installations against both malign activity as well as grid outages andr instability.
- Enable net-zero carbon electricity and heat systems.

DIU PM, Michael Callahan

DoD Partner(s)

- Secretary of the Air Force/Environmental, Safety & Infrastructure
- Army Office of Energy Initiatives
- Bureau of Land Management
- Navy Geothermal Program Office
- Department of Energy
- National Renewable Energy Lab

Prototyping Installations

- AF Mountain Home
- Army, Fort Irwin
- Army, Fort Wainwright
- Army, Fort Bliss
- Navy, El Centro
- Navy, Fallon

Commercial Vendor(s)
Eavor, Fervo Energy, GreenFire Energy, Sage Geosystems, Teverra, Zanskar

DEFENSE INNOVATION UNIT

Problem Curation | Diligence | CSO Process | Prototyping | Transition

HEAT PUMPS

Improving energy efficiency by using heat pumps for HVAC & Water Heating

Problem

The DoD owns and operates over 300 bases across a range of climate zones, which results in 33% of DoD total energy use, costing about $4B annually. Of that 95% is power for heating and cooling buildings, and 45% of that is for heating water for hot water uses.

Solution

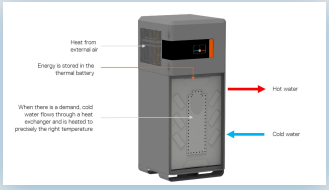
Commercially-available, industrial-grade, air and water heat pumps for heating, cooling and hot water systems.

Impact

The proposed solution will utilize commercial best practices and technology and will be tested at a U.S. government facility for 12 months to capture all seasonal data. If successful, the solution provider(s) will have demonstrated that the solution is life cycle cost effective and is broadly applicable to most DoD/USG buildings.

Blue Frontier

GTI



Intellihot

GTI

Partners	Commercial Vendors
• OSD/Environmental Security Technology Certification Program (ESTCP) • Air Force Reserve Base (Westover) • US Army (Fort Moore and Fort Gregg-Adams) • General Services Administration • Dept of Energy/National Renewable Energy Lab	• GTI Energy • Intellihot • Blue Frontier

DIU PM, Dr. Sujata Millick

DEFENSE INNOVATION UNIT

Problem Curation | Diligence | CSO Process | Prototyping | Transition

Shadow Monitoring

"Creating data advantage" with real time access to installation level power and water consumption

Problem

DoD does not have timely and comprehensive installation level data for electricity, natural gas, and water consumption for effective decision making to execute EO 14057 sustainability requirements.

Solution

Install inline parallel meters or "shadow meters" at the fenceline at installations that can reflect total installation usage.

Impact

- Make DoD installations more resource efficient by measuring total demand and consumption of commodities at the installation level
- Match DoD energy demand with carbon free energy either from the utility or developed on site through access to real time load information
- Reduce billing errors and assess billing rates through timely evaluation of utility bills
- Aggregate and securely transmit data for analysis

DIU PM, Andrew Mawdsley

DoD Partners	Commercial Vendor(s)
• Office Secretary of Defense • Army - Rock Island Arsenal • Navy - NAS Corpus Christi • Marine Corps - MCAS Beaufort • Air Force - Hurlburt Field	• Schneider Electric

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Finance First

Problem Curation | Diligence | CSO Process | Prototyping | Transition

Compressing energy project timelines and reducing cost through innovative financing structures.

Problem

Deploying resilient on-installation energy generation projects takes too long and costs too much. Process improvement is needed to compress time to completion and reduce costs.

Solution

- Employ best-in-class turnkey project planning and financing techniques prevalent in private industry that result in start-to-finish timelines of 2-3 years vs 5+ years currently prevalent in the DoD.

Impact

- Compress timeline to deploy resilient, renewable energy solutions
- Reduce delivered cost of energy through long-term financing structures
- Improve installation resilience against malign actions and grid failure

DoD Partner(s)	Commercial Vendor(s)
• SAF/IEE • US Navy (prospective)	• TBD

DIU PM, Mike Kahmann

DEFENSE INNOVATION UNIT

Problem Curation | Diligence | CSO Process | Prototyping | Transition

Mobile Electric Generation for Austerity

Exportable Vehicle Power for Distributed Warfighting Tagline here.

Problem

Operational and tactical commanders lack the ability to provide constant and reliable power to land-based weapon systems in non-grid connected, austere, and expeditionary environments. Current systems consume inordinate amounts of liquid fuel that will significantly challenge movement, maneuver, and sustainment operations.

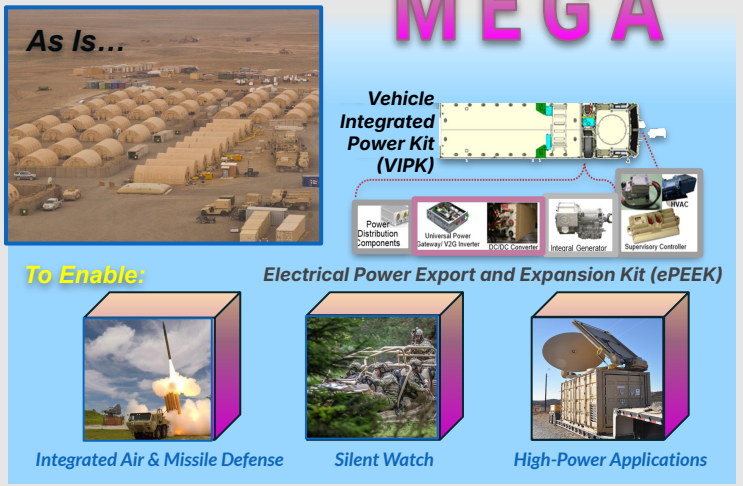
Solution

Develop and integrate a "mild" hybrid electrification retrofit kit into a relevant base vehicle to (1) advance anti-idle capabilities, (2) provide high voltage power, (3) reduce lift/transportation demands by eliminating towed generators and associated inflexible equipment

Impact

- Increase fuel efficiency and decrease air/sealift requirements
- Extend days of supply of limited existing energy stocks
- Modular/flexible kits to upgrade any vehicle to export power
- Enable new warfighting concepts of Multi-Domain Operations and Expeditionary Advanced Base Operations through high voltage exportable vehicle power
- Expand options for low-signature operations and silent watch with legacy tactical systems

DIU PM, Kawakahi Amina



DoD Partner(s)	Commercial Vendor(s)
• OUSD A&S OE-I • PEO CS&CSS • JPO JLTV • PM THAAD • PM E2S2 • PM TS • Army GVSC • DEVCOM	• TBD

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Problem Curation | Diligence | CSO Process | Prototyping | Transition

STABLE TACTICAL EXPEDITIONARY ELECTRICAL POWER

Tactical Contested Logistics - Energy Storage and Management

Problem

The need for units to operate from austere, remote overseas locations where the efficient use and storage of energy will play a vital role in military operations is steadily increasing. Units will need to operate independently in dispersed locations for longer periods of time, while simultaneously reducing logistical requirements and a reliance on fossil fuel as a primary energy source.

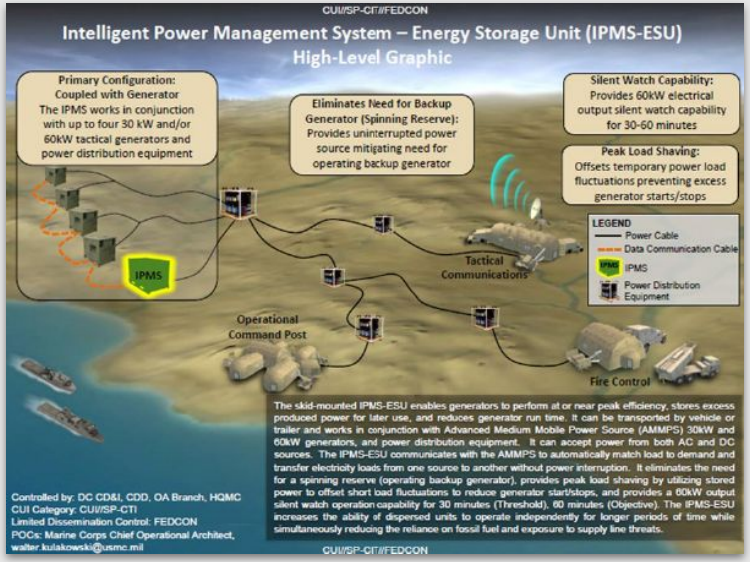
Solution

- Develop a modular, scalable, vehicle transportable system capable of providing various forms of power production and management for electrical grids of up to 300 kilowatts (kW).
- Employ an intelligent power management system to existing Advanced Medium Mobile Power Sources (AMMPS) generators to include energy storage.

Impact

- Increases tactical generator fuel-efficiency enabling dispersed units to operate independently for longer periods.
- Decreases exposure to fuel supply line threats.
- Enable silent watch operations that eliminate the noise, heat, and emissions signature of coupled tactical generators.
- Reduced fuel usage/costs with the follow-on benefit of also reduced carbon emissions.

DIU PM, Jack Ryan



DoD Partner(s)	Commercial Vendor(s)
• Marine Corps Systems Command (MCSC) • US Army C5ISR • MIT Lincoln Laboratory (MIT-LL) • NSWC, Carderock • Army Army Test and Evaluation Command (ATEC)	• Cummins Power Generation • GM Defense

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Problem Curation | Diligence | CSO Process | Prototyping | Transition

Synthetic Fuels in Contested Environments

Increasing energy resiliency through synthetic fuel production

Problem

Defense fuel / operational energy logistics are reliant on the global energy supply chain, which is easily disruptible. Current transport means are costly, inefficient, slow, and vulnerable to attack.

Solution

Creation of a highly-agile, rapidly-deployable synthetic fuel production system that could be dispersed throughout any AOR to produce just-in-time fuel at the edge via non-Fischer-Tropsch power to liquids technology, leading to 35% efficiency increase over traditional SAF methods. Produce synthetic hydrocarbon fuels (jet fuel, diesel, etc.) on-site, from ubiquitous feedstocks such as air or seawater, in a small, mobile form-factor that enables agile combat employment concepts. MOBILE SynCE transportable by c130 and mil forklift.

Impact

Independence from the global energy supply chain
Carbon neutral fuel usage in expeditionary & static CONUS and OCONUS sites

DIU PM, Matt Palumbo

DoD Partner(s)	Commercial Vendor(s)
• AFRL & TCO • DOE • OECIF • US Army OCE (SMR Integration) • USA Corps of Engineers • NORTHCOM / SOUTHCOM / CENTCOM / TRANSCOM • PEO CS&CSS • PEO SOFSA	• Air Company

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Problem Curation | Diligence | CSO Process | Prototyping | Transition

Arctic Grid Energy Storage (AGES)

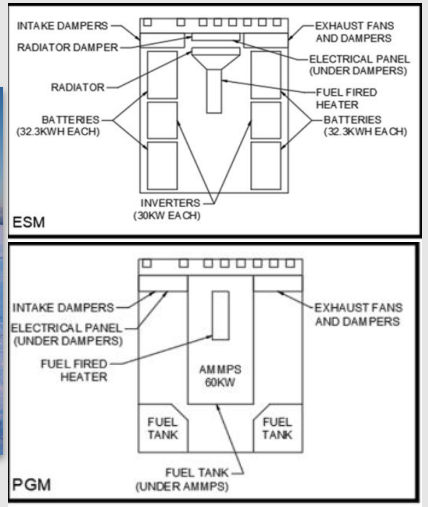
Modular, Transportable, Energy Storage in the Arctic Region

Problem

As a result of climate change, the Arctic is increasingly accessible. With recent aggression from adversarial nations, it is rapidly becoming a new front line with unique energy demands and operational considerations to deploy and withstand the extreme cold of the Arctic.

Solution

- Energy storage and generation in extreme cold weather -60°F (-51°C)
- 3 x insulated bi-containers (1 x Power Gen (PGM) & 2 x Energy Storage (ESM)) with active heating that yields 250kwh
- C-130 deliverable and mil forklift transportable
- AGES is the first modular system that is Tactical Microgrid System (TMS) compliant
- Higher power quality for mission critical equipment such as medical facilities and CoCs



Impact

Operational prototype will support Arctic Edge in FY24. The microgrid may be adopted as part of the cold weather program of record for the Army Expeditionary Energy and Sustainment Systems.

DIU PM, Matt Palumbo

DoD Partner(s)

- NORTHCOM J4 (AOR)
- NORAD (govt partner)
- OUSD(A&S)/ OECIF ($$$)
- USA/ PM E2S2 (Transition)
- USACE/ ERDC-CRREL (Alaska and NH cold weather testing)

Commercial Vendor(s)

- HDT
- SEL (sub: software, microgrid controllers, and cybersecurity)
- Oztek

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Problem Curation | Diligence | CSO Process | Prototyping | Transition

Electrified Ground Support Equipment

Increasing range, endurance, and operational flexibility in contested environments .

Problem

Support equipment that handle, service and test aircraft comprise a significant carbon footprint on DoD installations globally.

Solution

- Militarize commercial electric tow tractors and dollies with heightened performance and design characteristics, including advanced battery safety represented by DIU's JABS program, electromagnetic hardening, modular hybrid capabilities, and ease of maintenance.
- Supporting the solution will be installation of charging stations at each of the joint service demo sites.

Impact

Tow tractors represent 72% of combustion-powered SE vehicle inventory averaging 3.3 gal/hr in fuel consumption. Electrifying Mid-range tugs will improve energy efficiency, reduce scheduled and unscheduled maintenance (lower engine wear at idle and fewer moving parts), increase performance (greater torque from full stop), while lowering emissions and noise.

DoD Partner(s)	Commercial Vendor(s)
• Naval Air System Command - Common Aviation Support Equipment Program (PMA 260) • USMC Expeditionary Energy Office (E20) • Air Force Research Lab outreach • Army Aviation outreach	• TBD

DIU PM, Mike Kahmann

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