

DEPARTMENT OF THE NAVY

STP

SBIR/STTR TRANSITION PROGRAM

Navy Forum for SBIR/STTR Transition Project Book



Sea-Air-Space 2021

What is a Department of Navy's Forum for SBIR/STTR Transition (Navy FST) focused technology event?

The Navy FST focused technology events promote companies participating in the Navy SBIR/STTR Transition Program (Navy STP). Navy FST events connect these small businesses with government and industry personnel through Tech Talks and Meet the Experts one-on-one meetings, and an enhanced online presence via the Virtual Transition Marketplace (VTM).

Since these projects are selected and funded by the Navy System Commands, SBIR/STTR projects are an indicator of the voice of the customer. This view into the Navy's investments and the companies generating the technical solutions provides awareness of emerging technologies important to the customer and can indicate strong potential partners, teammates and suppliers. Consider DoN SBIR/STTR investments when choosing topics for internal research and development focus; leveraging SBIR/STTR projects can be an advantage when communicating with the customer.

At the Sea-Air-Space event, the Navy STP will be showcasing 48 projects at our Tech Talk Theatre located in the Maryland Hall. 24 project overviews will be presented on 2 August; the second 24 will be presented on 3 August

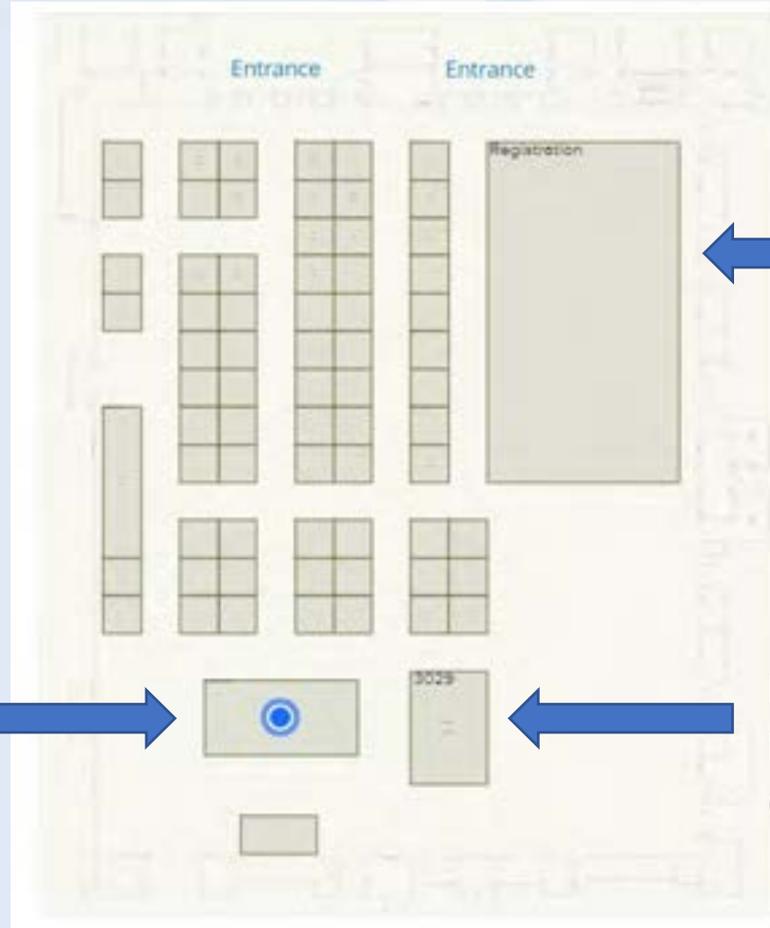
Showcased SBIR/STTR Technologies at Navy FST Tech Talk Theatre on 2 August

- Air Platforms
- Energy and Power Technologies
- Ground and Sea Platforms
- Human Systems
- Sensors
- Space
- Weapons Technologies

Showcased SBIR/STTR Technologies at Navy FST Tech Talk Theatre on 3 August

- Advanced Electronics
- Autonomy
- Biomedical
- Command, Control, Communications, Computers, & Intelligence
- Cyber
- Electronic Warfare
- Engineered Resilient Systems
- Materials & Manufacturing Processes
- Modeling and Simulation Technology

Tech Talk Theatre Maryland Hall



**Event
Registration**

**Navy FST
Tech Talk Theatre
(3024)**

**Navy FST Reserved
Meeting Space
(3029)**

Tech Talk Schedule

2 August – Maryland Room



1000	Air Platforms	Corrdesa	N112-154	Selective Electroplating Technology Improvement (SETI)
1015	Air Platforms	Corrdesa	N162-129	Optimized Galvanic Corrosion Control of Repair Bushings and Fasteners Utilizing Advanced Performance Organic Coatings
1030	Air Platforms	Mainstream Engineering Corporation	N181-005	Improving Lifetime of Generators on Legacy Aircraft
1045	Air Platforms	NexTech Materials, Ltd. dba Nexceris, LLC	N181-013	Compact, Lightweight, Power-Dense Integrated Fuel Cell System
1100	Air Platforms	Platform Aerospace	AF171-124	Ultra-Endurance UAV
1115	Air Platforms	Precision Combustion, Inc.	N182-118	System for Onboard Engine and Bleed Air Monitoring and Filtering
1130	Energy & Power Technologies	Piasecki Aircraft Corporation	N17A-T007	Piasecki Lightweight Sensor Pod
1145	Energy & Power Technologies	Candent Technologies Incorporated	N132-086	Prime Power System Development for Active Denial Technology (ADT) and High-Power Radio-Frequency (RF) Systems
1200	Ground and Sea Platforms	Great Lakes Sound & Vibration, Inc.	N181-039	Common Unmanned Underwater Vehicle (UUV) Stern Launch and Recovery System
1215	Ground and Sea Platforms	Pacific Engineering, Inc	N171-072	Light Weight Composite Components for Naval Systems
1230	Ground and Sea Platforms	RE2, Inc.	N151-066	Vanilla UAS Capability Overview
1245	Ground and Sea Platforms	Sphere Brake Defense, LLC	N173-142	Advanced Tactical Sphere Brake
1300	Human Systems	BGI LLC	N181-026	Data Science Based Aircrew Performance Assessment Tools
1315	Human Systems	Charles River Analytics Inc.	N162-124	Simulating Training Results to Understand Differing Effects of fidelity on Learning (STRUDEL)
1330	Human Systems	Charles River Analytics Inc.	N172-132	Adaptive Training Protocols (ATP)
1345	Human Systems	Charles River Analytics Inc.	N151-077	Strengthening Health and Improving Emotional Defenses (SHIELD)
1400	Human Systems	2 Circle Consulting, Inc	N181-026	Reconstruction and Assessment of Proficiency in an Integrated Debrief
1415	Sensors	Beam Engineering for Advanced Measurements Company	N181-022	Laser Periscope Detection
1430	Sensors	Prime Photonics, LC	N162-097	Non-Contact Torque Sensor for Unmodified Composite Shafts and Non-Ferrous Metal Shafts
1445	Sensors	Q Peak, Inc.	N141-008	Multi-Color Laser
1500	Space	Atmospheric & Space Technology Research Associates	N16B-T026	Ocean Surface Vector Winds (OSVW)
1515	Weapons Technologies	Infibertech, Corp.	N162-076	Miniaturization of GPS Alternative Survey Equipment
1530	Weapons Technologies	VJ Technologies Inc.	N153-132	High Energy High Flux X-ray Detector

Tech Talk Schedule

3 August – Maryland Room



0900	Advanced Electronics	Creare LLC	N172-123	Sea State Prediction System
0915	Advanced Electronics	International Electronic Machines	A02-075	Non-Contacting Torque Sensor for Helicopter Tail Rotor Drive Systems.
0930	Autonomy	Scientific Systems Company, Inc	N181-061	Mission Planning
0945	Biomedical (ASBREM)	Vivonics, Inc.	N171-002	Intranasal Cooling for Encephalopathy Prevention in Combat Casualties (ICEPICC)
1000	C4I	Aptima, Inc.	N17B-T032	TACTIC-D II: Techniques to Adjust Computational Trends Involving Changing Data
1015	C4I	FIRST RF CORPORATION	N171-001	Beyond Line of Sight (BLOS) High Data Rate Communications
1030	C4I	FIRST RF CORPORATION	N163-140	Curved (Convex) Surface Global Positioning System (GPS) Antenna Design for Submarine Launched Ballistic Missile (SLBM) Trident D5 Flight Test Reentry Bodies
1045	C4I	Fuse Integration, Inc.	N181-007	Robust Communications Relay with Distributed Airborne Reliable Wide-Area Interoperable Network (DARWIN) for Manned-Unmanned Teaming in a Spectrum Denied Environment
1100	C4I	GIRD Systems, Inc.	N161-049	Beyond-Line-of-Sight, Anti-Jam, Networked Sensor Data Link
1115	C4I	Intelligent Automation, Inc.	N181-033	IDA: Intelligent Digital Assistant
1130	C4I	Lynntech, Inc.	N182-127	Fooling Computer Vision Classifiers with Adversarial Examples
1145	C4I	Skayl LLC	N181-053	Leveraging a Robust Data Architecture for Rapid Combat System Integration, Testing, and Certification
1300	Cyber	La Jolla Logic, Inc.	N132-140	Cognitive Autonomous Artificial System Intelligence (CAASI)
1315	Cyber	Real-Time Innovations	N171-050	Software-based Modular and Extensible Cybersecurity Framework for Combat Systems
1330	Cyber	TDI Technologies, Inc.	N16A-T013	CYBER FORENSICS TOOLKIT (CyFT)
1345	Engineered Resilient Systems (ERS)	Beacon Interactive Systems	N171-071	Plug-and-play Analytical Framework for Distributed Structured and Unstructured Data Sets for Condition Based Maintenance Plus (CBM+)
1400	Electronic Warfare (EW)	HYPRES. Inc.	N17A-T027	Energy Efficient, Non-Silicon Digital Signal Processing (DSP)
1415	Electronic Warfare (EW)	Phase Sensitive Innovations, Inc.	N182-101	Multicore Fiber Optic Package Optical Subassembly for Wideband Digital and Analog Photonic Links
1430	Modeling and Simulation Technology	Design Mill, Inc.	N172-101	Shipboard Dimensional Analysis Tool (SDAT)
1445	Modeling and Simulation Technology	Freedom Photonics LLC	N182-108	Photonic Integrated Circuit Reliability Prediction, Verification and Validation
1500	Materials & Manufacturing Processes	NALAS Engineering Services Inc.	N16A-T021	High Performance Energetic Propellant Ingredient Process Research and Development
1515	Materials & Manufacturing Processes	Plasma Processes, LLC	N131-071	Coating Solutions for Hypersonic Projectiles
1530	Materials & Manufacturing Processes	Product Innovation and Engineering L.L.C.	N162-087	Onsite Structural Restoration Methods for Aircraft Components
1545	Materials & Manufacturing Processes	Product Innovation and Engineering L.L.C.	N181-028	Precision Machining of Composite Structures

At the Sea-Air-Space event, the Navy STP will host 48 projects at the Navy FST booth on the main conference exhibition hall. 24 projects will have display space on 2 August giving participants a chance to meet the experts one-on-one. The second 24 technologies will have space the next day on 3 Aug.

Featured SBIR/STTR Technologies at the Navy FST Booth on 2 August

- Advanced Electronics
- Autonomy
- Biomedical
- Command, Control, Communications, Computers, & Intelligence
- Cyber
- Electronic Warfare
- Engineered Resilient Systems
- Materials & Manufacturing Processes
- Modeling and Simulation Technology

Featured SBIR/STTR Technologies at the Navy FST Booth on 3 August

- Air Platforms
- Energy and Power Technologies
- Ground and Sea Platforms
- Human Systems
- Sensors
- Space
- Weapons Technologies

Navy FST Booth Main Exhibition Hall



Navy FST Booth (537)



Featured Technologies

- Advanced Electronics
- Autonomy
- Biomedical
- Command, Control, Communications, Computers, & Intelligence
- Cyber
- Electronic Warfare
- Engineered Resilient Systems
- Materials & Manufacturing Processes
- Modeling and Simulation Technology

Advanced Electronics (Navy FST Booth: 2 August)



Company	Topic	Project Title
Creare LLC	N172-123	Sea State Prediction System
International Electronic Machines	A02-075	Non-Contacting Torque Sensor for Helicopter Tail Rotor Drive Systems.

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

Topic # N172-123

Wave Characterization from Improved Navy Lighterage System (INLS) Warping Tug

Motions

Creare LLC

WHO

SYSCOM: NAVFAC

Sponsoring Program: Improved Navy Lighterage System (INLS)

Transition Target: INLS Warping Tug

TPOC:

Mr. Marty Fickel
(805)982-1307

martin.fickel@navy.mil

Other transition opportunities: The size of the market could grow to several hundred units if the system were to be used on Navy Causeway Ferries, Land Craft Utilities, Land Craft Air Cushion, and Army landing craft. The system can be commercialized by ship builders and is also suitable for foreign military sales.

Notes: The Warping Tug is the backbone of the Improved Navy Lighterage System. The flat bottom hull structure provides a very stable platform to work around ship to shore vessels and the causeways connecting them to shore. The vessel is rated to safely operate up to sea state 3.



US Navy Photo

WHAT

Operational Need and Improvement: The Improved Navy Lighterage System (INLS) has expanded Naval capabilities. The INLS enables cargo transfer in areas of operation where access to port facilities is limited or contested and is the backbone of logistic support for humanitarian assistance and disaster response missions. However, the INLS is only designed to be operated at Sea State 3 or below. Sea state determination, while critical to safe operation of the INLS, is currently made subjectively by Navy personnel—a process that is very difficult and highly dependent on the experience of the individual making the determination. To address this issue, Creare is developing a Sea State Predictor to enable automated, highly reliable determination of sea state.

Specifications Required: The system must be capable of determining the local wave environment in near real-time, including significant wave height, the associated period, and the predominant wave direction. The ideal system would calculate these parameters using only the recorded motions from the INLS warping tug and would not require the deployment or use of other ancillary wave measuring equipment. The system must be compatible with the existing warping tug interfaces, and require as little modification to existing infrastructure as practicable. Wave characteristics must be displayed and recorded locally on a graphical user interface.

Technology Developed: Creare's Sea State Predictor (SSP) determines sea state from motions of the INLS warping tug. The system relies on commercial hardware components combined with a custom software code to measure the motion of the tug when mounted in the pilothouse. These inputs are then processed using a numerical model of vessel geometry and wave response to determine sea state, significant wave height, and wave period. The SSP leverages the warping tug itself as a "wave gauge." A major benefit of this approach is that the entire system is contained in a small box on the bridge of the warping tug. The system includes an Inertial Measurement Unit (IMU) containing accelerometers and gyroscopes that measure all six degrees of freedom of the motion of the tug. Analytical models are used to account for the fact that the warping tug's motions will not follow the water surface exactly. For example, small wind chop may not cause any vertical motion of the tug, while larger swells whose period correspond to the inherent resonance of the tug may result in larger than expected heaving motions. This response is captured in a numerical model of how the tug responds to incident waves. A family of models is used to capture the nonlinear behavior of the tug in different wave conditions.

WHEN

Contract Number: N68335-19-C-0579 **Ending on:** September 24, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Characterization of scale model in wave tank	Low	Accurate modeling of vessel motion	2	July 2019
Validation of IMU for the application	Low	IMU deemed appropriate	3	August 2019
Validation of noise filters and measuring vessel dynamic response	Med	Signal strength meets targets	4	March 2020
Prototype SSP developed	Med	Navy accepts design	4	November 2020
Prototype testing and evaluation	Med	Performance validated against gold standards	5	February 2021

HOW

Projected Business Model: Manufacturing and Distribution Plan. In 2010 Creare created a sister firm (Edare) for the purpose of transitioning our research efforts into commercial products. Edare has its own in-house fabrication, assembly, and engineering capabilities in a 20,000 sq. ft. facility located in Lebanon, NH. Edare has transitioned another system developed by the Creare project team into a full commercial product. This system is an optical measurement tool used to measure fastener flushness with respect to the skin of the F-35 aircraft. The underlying technology was developed at Creare and then transitioned to Edare who finalized the mechanical design to assist in manufacturability. Edare is currently building systems for sale to the commercial market, training the customer on use of the system, and providing field support for previously sold systems. Creare will use the same approach to manufacture, sell, and sustain Sea State Prediction Systems.

Company Objectives: Fully qualify prototype pre-production units, then build, provide, and sustain SSPs for the Navy.

Potential Commercial Applications: Creare's SSP innovation is designed for the Improved Navy Lighterage System but is adaptable to vessels with a variety of hull forms where increased capability of anticipating and reducing vessel response is needed. Specifically, SSP measurements and algorithms could integrate with PEO Ships' Environmental Ship Motion Forecasting (ESMF). Like ESMF, Creare's SSP is a tool that forecasts wave motion and ship motion response. Our SSP could integrate with, or replace elements of ESMF, to extend the operational environment for various missions by predicting time periods or ship headings where cargo movement may be conducted despite sea states normally considered beyond safe operating limits.

Contact: Paul Movizzo, DoD Business Development
pgmovizzo@creare.com 603-640-2539

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

NAVAIR 2020-842

Topic # A02-075

Non-Contacting Torque Sensor for Helicopter Tail Rotor Drive Systems.
International Electronic Machines

WHO

SYSCOM: NAVAIR

Sponsoring Program: H-53 Heavy Lift Helicopters Program Office (PMA-261)

Transition Target: CH-53K IHSMS

TPOC:
(301)342-9428

Other transition opportunities: H-60, CH-47, and other rotorcraft

Notes: IEM's flagship WISE® suite of railroad safety and maintenance inspection products were developed and derive from SBIR work, some dating back to 1997 and others through the 2000s. Our USDOT Transportation Autonomous Device (TAD) unmanned railroad inspection vehicle had its further development funded by a Class One railroad for millions of dollars, and our Vibration Monitoring System (VMS) for Sound Transit derives from SBIR projects in vibration and acoustic sensing, and the current TMS is a continuation of both early SBIR work through 2007 and other testing and development work with two major aircraft manufacturers. Multiple other commercial or non-SBIR government projects had their genesis in other SBIR projects with both military and non-military Federal agencies.

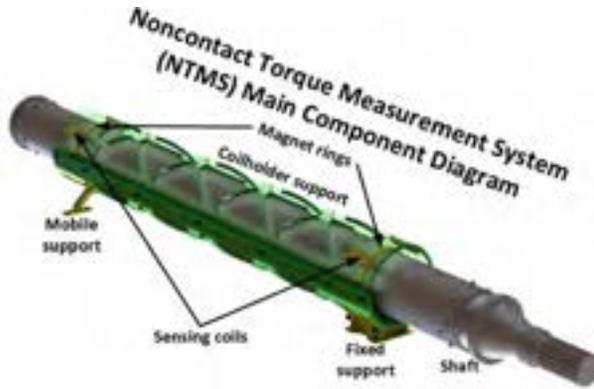


Diagram of the NTMS by IEM Corp., Copyright 2020

WHAT

Operational Need and Improvement: Rotorcraft expend the majority of their power (~70%) to lift the craft into the air. The remaining ~30% determines cargo capacity, maneuvering power, and so on. Current-art systems for measuring torque are generally contact (thus subject to wear) and often cannot achieve accuracies over +/-4%. This limits the safe operation of the rotorcraft, and prevents the use of condition-based maintenance (CBM) on the shaft and related components (as accurate strain/torque measurement is necessary for condition tracking). There is thus a need for an accurate (~1% or better), noncontact, easily-installed method for torque measurement on rotorcraft.

Specifications Required: The desired system will provide accurate (to 1%) torque measurements in real-time with no contact involved, add no more than 10 pounds of weight, and maintain a clearance of at least 1/2" nominal from the shaft in operation; the system should be easily installed and require no permanent changes to the shaft. High-speed sampling (to detect torque transients), lower weight, and higher accuracy are desirable.

Technology Developed: IEM has developed a patented, accurate, low-power, high-speed method to measure torque on an operating rotorcraft driveshaft (or other similar shafts). IEM's Noncontact Torque Measurement System (NTMS) can be retrofitted to existing aircraft without permanent changes to the shaft, achieves an accuracy of 1% full-scale torque measurement, and can achieve liftoff of over 0.75 inches in operation. The system is lightweight (well under 10 pounds) and will provide data of sufficient accuracy and frequency for use in CBM or in direct flight operations. The system neither produces significant EMI nor is easily interfered with by external EMI. It is potentially able to be self-powered and/or wireless as well.

Warfighter Value: The use of the NTMS would provide operators of rotorcraft with the ability to safely make use of a greater proportion of the maneuvering and lift torque of the craft, while also allowing a more reliable and cost-effective way of ensuring the operational safety of the shaft and related components. This translates overall to reduced maintenance time and replacement costs, improved safety, and improved operational performance of the aircraft.

WHEN

Contract Number: N68335-19-C-0237 **Ending on:** April 9, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prior Test Data Delivered	N/A	Testing data obtained and verified usable	6	May 2019
Shaft motion characterized and coilholder base design determined	N/A	Coilholder design created that meets performance and weight guidelines	6	May 2020
New Testbed Constructed	Low	Testbed design and construction to meet motion parameters	6	November 2020
New Prototype Tests Completed	Low	Complete tests with redesigned prototype	6	January 2021
Complete final design for Flight Test	Med	Based on test results create design that addresses any issues seen	6	April 2021
Flight Testing	Med	Install NTMS on Test Aircraft and fly	7	October 2022

HOW

Projected Business Model: IEM expects to manufacture the TMS in our facilities at a low production rate. If demand is sufficient, IEM may expand our facilities, or license manufacturing to a larger concern. IEM already manufactures our other major products on-site and understands these processes well.

Company Objectives: The NTMS began as a Phase I and II with the U.S. Army through 2007; this became a Phase III with a major rotorcraft manufacturer, who has then supported this Phase II.5 for additional development. IEM wishes to meet with other major rotorcraft or aircraft manufacturers, or any other manufacturers/users of vehicles with instrumentable driveshafts that could make use of this technology. While IEM can manufacture at low volume, licensing or other arrangements are possible.

Potential Commercial Applications: The NTMS technology has broad commercial applications, starting with all commercial rotorcraft; the same basic needs and limitations of military rotorcraft apply to civilian rotorcraft and thus the NTMS offers the same advantages for the operation and maintenance of the aircraft. In a broader sense, the NTMS applies to any vehicle, ground, sea, or air, which has its motive force transferred through a shaft at any point; it also may apply to any power generator or motor with a significant shaft length to be monitored.

Contact: Ryk Spoor, Research and Development Coordinator
rspoor@iem.net (518) 268-1636 ext 125

Autonomy (Navy FST Booth: 2 August)



Company	Topic	Project Title
Scientific Systems Company, Inc	N181-061	Integration of Autonomous Unmanned Systems in Theater Undersea Warfare Mission Planning

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0413

Topic # N181-061

Total Infrastructure and Mission Planning Suite

Scientific Systems Company, Inc

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS TM

Transition Target: AN/UYQ-100 Undersea Warfare Decision Support System (USW-DSS)

TPOC:

Other transition opportunities: ASW mission planning and execution tools similar to USW-DSS.

Notes: Image shows part of a theater-scale TIMPS ASW mission plan using both manned and unmanned assets.

Note #1: potential target track in red; Note #2 (a,b,c): stationary and mobile unmanned sensor assets; Note #3: tripwire performance plot; Note #4: TIMPS-proposed manned asset prosecution tracks in green; Note #5: unmanned aerial assets for communications relay (blue triangles).

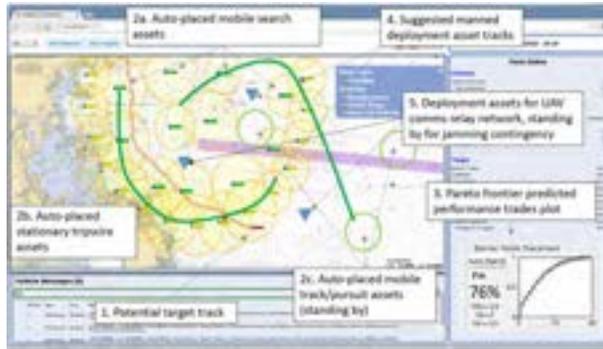


Image courtesy of Scientific Systems Company, Inc., 2020 (Geographic Location: Massachusetts Bay)

WHAT

Operational Need and Improvement: Augment human-driven theater-level mission planning with an automated toolset to plan large numbers of autonomous assets while integrating with existing tools. Operational needs are identified in (1) Chief of Naval Operations Adm. John Richardson, "The Future Navy", U.S. Naval Institute document, 17 May 2017 and (2) Commander's Intent for the United States Submarine Force and Supporting Organizations, March 2018, including theater anti-submarine warfare, C2 & decision, defensive anti-submarine warfare, and USW on-demand battlespace shaping.

Specifications Required: Develop a theater-level ASW planning toolset that is mission-, infrastructure-, and adversary-aware, and scalable to reactive replanning for large numbers of autonomous assets for theater ASW C2 and communications resulting in >10x accelerated planning time for >30 ASW/comms assets, in representative simulation.

Technology Developed: The Total Infrastructure and Mission Planning Suite (TIMPS) is a theater-level ASW planning toolset that augments human planners with an automated system for planning missions that utilize large numbers of autonomous assets, i.e., greater than 30. It is mission-, infrastructure-, and adversary-aware, and scalable to reactive re-planning for large numbers of autonomous vehicles, included UUVs and UAVs. This technology benefits the warfighter by improving theater-level search coverage and infrastructure availability (comms, supplies, retrieval, engagement), resulting in equivalent, or better, performance than human-generated theater-level plans for teams of autonomous vehicles. Operators using this technology can expect superior plans that are generated at least 10 times faster than human-generated plans with at least 10 times better coverage.

Warfighter Value: Improvement in theater-level search coverage and infrastructural availability. Equivalent performance or better than a human-generated theater-level plan for large asset counts (>30). Key metric: Plans done in >10x less time, or done in comparable time with 10x fewer infrastructure gaps.

WHEN

Contract Number: N68335-19-C-0657 **Ending on:** July 29, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Build initial feature-complete optimization pipeline	Med	Coverage and infrastructure plans achieved	4	August 2020
Assess automated planner performance relative to notional baseline scenario	Med	Coverage and infrastructure availability equivalent or better than human plans	4	August 2020
Improve optimization pipeline for plan quality and re-plan stability, and to handle larger scenario variety	Med	Plans improved over previous milestones, re-planning achieved	5	July 2021
Demonstrate on realistic contractor-generated scenario data	Med	Availability better than human plans in semi-realistic mission scenario	5	July 2021

HOW

Projected Business Model: TIMPS is a software application that will be sold directly to the Government.

Company Objectives: Scientific Systems Company, Inc. (SSCI) will coordinate with U.S. Navy and Industry stakeholders to develop this technology in concert with the Navy's roadmap for large-scale unmanned system integration into the Fleet. Understanding the Navy's vision and roadmap for unmanned systems is key to successfully developing and transitioning this technology. SSCI will identify other mission planning capabilities available to the Navy Enterprise and pursue opportunities to collectively advance this technology for the benefit of the U.S. Navy. SSCI specializes in applying artificial intelligence to autonomous unmanned systems for complex, collaborative missions. Our goal is to integrate and transition this technology into government and prime contractor systems to realize unmanned systems as a force multiplier.

Potential Commercial Applications: Commercial applications for TIMPS include applications where unmanned systems work in coordination with human operators to optimize search coverage and infrastructure availability including security, law enforcement, disaster relief, salvage & rescue operations, and scientific exploration.

Contact: Jeremy O'Neal, Program Director, Maritime Programs
Jeremy.ONeal@ssci.com 781-933-5355 x337

Biomedical (Navy FST Booth: 2 August)



Company	Topic	Project Title
Vivonics, Inc.	N171-002	Intranasal Cooling for Encephalopathy Prevention in Combat Casualties (ICEPICC)

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

MCSC-PRR-3577

Topic # N171-002

Phase II: Intranasal Cooling for Encephalopathy Prevention in Combat Casualties (ICEPICC)

Vivonics, Inc.

WHO

SYSCOM: MARCOR

Sponsoring Program:

Transition Target:

TPOC:

sbir.admin@usmc.mil

Other transition opportunities: The key Department of the Navy customers include Battalion Aid Station (BAS), Shock Trauma Platoon (STP), Forward Resuscitative Surgical Suite (FRSS) and En Route Care System (ERCS) Authorized Medical Allowance Lists (AMALs).



Conceptual rendering of the Intranasal Cooler for Encephalopathy Prevention in Combat Casualties (ICEPICC) system that delivers tympanic membrane feedback brain cooling through the nasal cavity. Photo courtesy Vivonics, Inc.

Notes: The device could be stocked in FRSS facilities, in ambulances and medical evacuation (medevac) helicopters, and at Role 3-4 hospitals. To address DOD needs beyond the USMC, we will work with US Army Medical Materiel Agency (USAMMA) Advanced Development to introduce ICEPICC as part of the standard Army Medical Equipment Sets (MES) employed by medical personnel at each appropriate care Role from point of injury through to hospital settings.

WHAT

Operational Need and Improvement: Brain cooling can prevent encephalopathy during events like traumatic brain injury, stroke, cardiac arrest, and respiratory failure, where blood oxygen availability is low, swelling is prevalent, and intracranial pressure is high. Cooling of the vessels within the nasal cavity as well as the barrier between the nasal cavity and the brain is a minimally invasive technique used to reduce brain temperature back to normal (normothermia) or even below normal body temperature (therapeutic hypothermia) without requiring cranial access.

Specifications Required: Vivonics, Inc. has been developing a portable system to provide a level of cooled airflow (<10C @ 25 liters per minute) shown conducive to lowering pig brains to both normo- and therapeutic hypothermic temperatures for over 4 hours from Role 1 through En Route Care.

Technology Developed: The Intranasal Cooler for Encephalopathy Prevention in Combat Casualties (ICEPICC) is a portable device which will enable intranasal cooling to be performed by a combat medic or paramedic, by affixing a nasal cannula and temperature probe to the patient and setting the desired brain temperature on a simple user interface. The thermoelectric cooler (TEC) based system was selected as the approach that thoroughly meets the needs of the Marine Corps because it does not require a pressurized air source, specialized reactant, or circulating liquid, it can be powered by battery and/or via an outlet, it will run off the chosen batteries for a minimum (without control strategy) of 13 hours, and it fits in a (12.8 x 7.8 x 6 in.) box that is less than 20 lbs.

Warfighter Value: According to a Defense and Veterans Brain Injury Center (DVBIC) analysis of surveillance data released by the Department of Defense (DoD), 375,519 U.S. military personnel were diagnosed with a TBI between 2000 and 2017, with a peak of 33,149 in 2011 alone. This number includes military personnel from the Army, Navy, Marine Corps, Air Force, and from the active duty and reserve components of the National Guard. To lessen the impact of TBI, the Navy would like to deploy brain cooling technology that could be applied at or close to the point of injury. However, there is currently no robust fieldable technology that can achieve the Dept. of the Navy's goals of an intracranial temperature range of 33 - 35°C to within ±1°C throughout an ambient operating temperature range of -32 to 52°C and therefore the Dept. of the Navy currently does not attempt to cool the brain after TBI, despite the significant potential in lessening the degree and impact of TBI. ICEPICC will address this unmet need.

WHEN

Contract Number: M67854-19-C-6502 **Ending on:** August 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Safety Animal Study Complete	Low	Proof-of-concept and safety of candidate devices/systems demonstrated in defined laboratory/animal models.	TRL 4	4th QTR FY20
Dose Animal Study Complete	Med	Investigational Device Exemption (IDE) review by Search Results Web results Center for Devices and Radiological Health (CDRH) results in determination that the investigation may begin.	TRL 5	4th QTR FY21
FDA Pre-submission Meeting	Low	IDE review by CDRH results in determination that the investigation may begin.	TRL 5	1st QTR FY22
Human Subject Pilot Study	High	Data from the initial clinical investigation demonstrate that the Class III device meets safety requirements and supports proceeding to clinical safety and effectiveness trials.	TRL 6	3rd QTR FY22
Human Subject Pivotal Trial	High	Clinical endpoints and test plans agreed to by CDRH.	TRL 7	1st QTR FY24

HOW

Projected Business Model: Licensing or partnering with an established medical device company for manufacture and delivery of ICEPICC is under consideration. Steve Weisner, Director of the Nihon Kohden's Innovation Center and Martin Waleij of BrainCool have both expressed interest in partnering. Mr. Waleij has said that the military market was not in their business plan but that BrainCool was interested in the potential market, potentially partnering with Vivonics to supply the military with novel devices like ICEPICC. Another possibility for distribution to the US Military is to supply the product through our CranioSense, LLC subsidiary, which was established to commercialize our non-invasive intracranial pressure (ICP) monitoring system called IPASS. Commonality of the target users and patient population for ICEPICC and IPASS makes it logical to establish joint marketing and distribution.

Company Objectives: While Vivonics is highly confident in the system it is developing and the commercial need, we do not understand the transitioning process well in terms of identifying, communicating with, and selling product to a military customer. Ultimately, we believe that the Navy will be a core customer, but seek assistance in understanding this process.

Potential Commercial Applications: Tens of thousands of patients die each year in the US due to neurological complications after cardiac arrest alone and targeted brain temperature management has been shown to improve survival and neurological recovery after cardiac arrest. Other indications for use include traumatic brain injury (TBI). The equivalent of an icepack for the brain, the ICEPICC is expected to improve outcomes in many cases of brain injury. According to the CDC, in 2010, about 2.5 million emergency department (ED) visits, hospitalizations, or deaths were associated with TBI—either alone or in combination with other injuries—in the United States. TBI contributed to the deaths of more than 50,000 people and was a diagnosis in more than 280,000 hospitalizations and 2.2 million ED visits. These consisted of TBI alone or TBI in combination with other injuries. The ICEPICC has the potential for both prophylactic cooling and therapeutic cooling to improve outcomes for these patients.

Contact: Ryan Myers, Lead Scientist and Director of Business Development
rmyers@vivonics.com (781)373-1930 x270

Company	Topic	Project Title
Aptima, Inc.	N17B-T032	TACTIC-D II: Techniques to Adjust Computational Trends Involving Changing Data
FIRST RF CORPORATION	N171-001	Beyond Line of Sight (BLOS) High Data Rate Communications
FIRST RF CORPORATION	N163-140	Curved (Convex) Surface Global Positioning System (GPS) Antenna Design for Submarine Launched Ballistic Missile (SLBM) Trident D5 Flight Test Reentry Bodies
Fuse Integration, Inc.	N181-007	Robust Communications Relay with Distributed Airborne Reliable Wide-Area Interoperable Network (DARWIN) for Manned-Unmanned Teaming in a Spectrum Denied Environment
GIRD Systems, Inc.	N161-049	Beyond-Line-of-Sight, Anti-Jam, Networked Sensor Data Link
Intelligent Automation, Inc.	N181-033	IDA: Intelligent Digital Assistant
Lynntech, Inc.	N182-127	Fooling Computer Vision Classifiers with Adversarial Examples
Skayl LLC	N181-053	Leveraging a Robust Data Architecture for Rapid Combat System Integration, Testing, and Certification

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-716

Topic # N17B-T032

TACTIC-D II: Techniques to Adjust Computational Trends Involving Changing Data
Aptima, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: Naval Air Systems Command (NAVAIR)

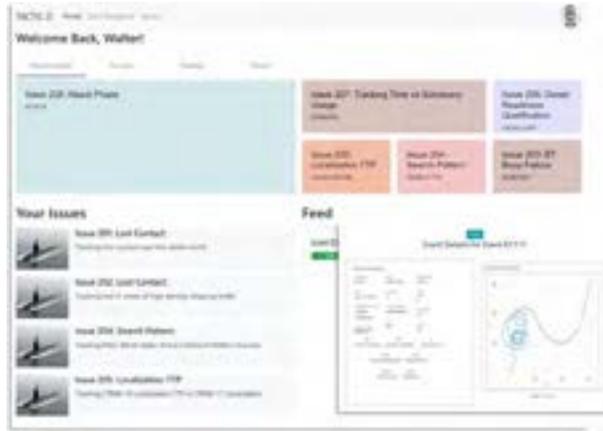
Transition Target: Commander Patrol and Reconnaissance Group (CPRG), PMA-290, PMA-205, PMA-264, PMA-299, PMA-275, PMA-265, PMA-231, PMA-298, PMW-750, and PMS-339

TPOC:

(407)380-4672

Other transition opportunities: The big-data analytics capabilities of TACTIC-D may be relevant for planning events in general. Tactical Training Group Pacific and Atlantic, as well as CSG-15, would have applications of this capability relevant to mission planning or Contingency Plan development activities. Air Force applications throughout the various platforms would be able to capitalize on the pattern detection abilities of TACTIC-D and be able to apply relevant tactics, techniques, and procedures to future missions, increasing mission success probabilities.

Notes: The accompanying image depicts the TACTIC-D portal in the background, and one possible characterization of an ASW (Anti-Submarine Warfare) event (here, a GenTrack or inferred track of submarine behavior) in the foreground. In this example, we understand that Walter's interest lies in ASW generally, and "lost contact" specifically. Issues of interest to Walter created by others appear in different colored cards at the top of the display. The Feed (partially hidden) provides analyses of trends in the features among Walter's "issues."



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WHAT

Operational Need and Improvement: The US Navy recognizes the potential for "big data" to facilitate force readiness. However, the analysis of such data presents numerous challenges, among them, (1) the evolving nature of Navy tactics, techniques, and procedures (TTPs), hindering apples-to-apples comparisons, (2) the presence of many interdependent platforms, making data complex, and (3) presenting analyses to humans, making understandability relevant.

Specifications Required: TACTIC-D must (1) implement statistical or computational methods capable of comparing measures of performance or proficiency continuously, as new data become available, (2) harvest data from multiple different sources, and (3) and present results to humans, across echelons, comprehensibly.

Technology Developed: Unlike competing approaches to comprehensive data analysis, our approach to TACTIC-D uses personalized issue tracking as its foundation and plug-in capability for its data analytics. The plug-in technologies (such as those supporting effects analysis, causal reasoning, predicate induction, and time-invariant skill trend analysis) provide different complementary lenses by which the user may explore and experiment with the data of interest. These technologies also mitigate the risk of TACTIC-D's technological obsolescence by allowing the plug-ins to evolve without affecting the supporting framework or workflow.

Warfighter Value: TACTIC-D is a tool (1) meant to fuse training and operational data from multiple different sources and (2) designed to encourage data exploration and critical thinking about issues related to force readiness and proficiency across echelons in the military establishment. Among other things, TACTIC-D allows users to test the effect of possible interventions without committing to an implementation of those interventions.

WHEN

Contract Number: N68335-19-C-0133 **Ending on:** February 25, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Implement personalized issue tracking framework	N/A	Demonstrate an interactive prototype that exercises the issue tracking framework	4	June 2020
Implement effects analysis functionality	Low	Demonstrate TACTIC-D's ability to support interventions, in silico	4	March 2021
Implement anomaly detection functionality	Med	Demonstrate how anomalies could be detected and tracked	4	July 2021
Implement time invariant skill trend analysis	Med	Demonstrate how warfighters' knowledge, skills, and abilities (KSAs) can be analyzed by mission, phase, TTP, and performance measure	4	September 2022
Access to relevant data sources	High	Demonstrate fusion of different sources of performance data across missions	4	December 2023

HOW

Projected Business Model: Aptima aims to build a baseline capability that enables the Fleet to utilize "big data" (data often characterized by its volume, variety, velocity, and variability) to (a) determine operational levels of effectiveness and (b) identify operational gaps that can be addressed through focused training events. TACTIC-D will have a predictive capability to analyze the probability of success of the recommended focused training events, without the Fleet having to commit to that training first.

Company Objectives: Aptima seeks to increase levels of Warfighter readiness and lethality by instrumenting Warfighters' environments with adaptive, scalable, technology-aided training. Aptima executes on the preceding---from the individual through integrated training, and across multiple functional areas---providing the precision to measure, assess, and adapt distributed training to support realistic, complex, and integrated training for the Naval Aviation Enterprise. Aptima's approach yields results that articulate readiness requirements---that define how readiness is measured, analyzed, integrated, and predicted to affect the DoD's return on its investments.

Potential Commercial Applications: TACTIC-D could help corporate managers evaluate the degree to which the expertise of the company's current employee population can perform successfully against the challenges of a different business model, to identify where training might be needed, and to prioritize training efforts to close these gaps in expertise. For example, TACTIC-D might have been a useful tool in forecasting the challenges of a corporate makeover involving a major US restaurant chain, in which the company rebranded itself as a preferred source for lunch and dinner rather than for breakfast alone. The challenge here is that the knowledge, skills, and abilities needed for making breakfast are not necessarily the same as those for making lunch or dinner, implying that gaps in skills and hiring could undermine the company's future success. A commercialized version of TACTIC-D could have been an aid to the company in planning its corporate makeover.

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Department of the Navy SBIR/STTR Transition Program

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MCSC-PRR-3640

Topic # N171-001

Beyond Line of Sight (BLOS) High Data Rate Communications

FIRST RF CORPORATION

WHO

SYSCOM: MARCOR

Sponsoring Program: PORTFOLIO MANAGER Command Element Systems

Transition Target: Forward operators

TPOC:
sbir.admin@usmc.mil

Other transition opportunities:



https://www.navsea.navy.mil/Portals/103/Images/TeamShips/PEOShips/M-XU431-039.JPG?ver=n_Ze7PwHNp0VXXiStV9YA%3d%3d

WHAT

Operational Need and Improvement: Marine Corps Systems Command (MARCORSYSCOM) needs lower Size, Weight, and Power (SWAP) communication links for Beyond Line of Sight (BLOS) applications to connect ground Marine Corps networks with Navy AFLOAT networks. These low SWAP BLOS communications approaches should use alternatives to low data rate HF or high SWAP Satellite Communications (SATCOM).

Specifications Required: BLOS communications approaches, not using troposcatter or HF radios, are needed to provide a high availability of 99.9% and high data rate of greater than 20 Mbps. A lightweight, portable and expeditionary architecture is required. The system must be able to be broken into components (expeditionary) that weigh no more than 20 lbs. each (portable) with a goal of less than 15 lbs. Each component must be able to be broken down to fit within a 2 ft cube and it is desired to minimize the size of all components for portability. The proposed system should address power concerns for the system to operate continuously on battery for 8 hours with a preference to a system than can run for 24 hours or more.

Technology Developed: FIRST RF has developed a modular antenna array to allow for BLOS communications. This new approach uses a ground relay located at a high point between the two ends of the link to provide the BLOS communication needs. This low-power approach reduces weight in both equipment and batteries. It operates at high data rates to minimize transmit time. Modular antennas allow each user to carry only the amount of equipment necessary to execute the mission.

Warfighter Value: Improving communications throughput, range and capability are key technology enablers for MARCORSCOM. This would allow for better interconnection of the ground Marine Corps network with the Navy AFLOAT networks.

WHEN

Contract Number: M67854-19-C-6501 **Ending on:** May 21, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I	N/A	Antenna gain and pattern measurements	2	2nd QTR FY18
Phase I Option	N/A	Elevation pattern measurements	2	1st QTR FY19
Phase II Baseline Program	N/A	BER measurements	4	3rd QTR FY22

HOW

Projected Business Model: FIRST RF is a product oriented company developing advanced technologies for antennas and Radio Frequency (RF) systems including communications, radar, phased arrays, Point Navigation and Timing (PNT), RF compatibility, low observable antennas, Electronic Warfare (EW), and Direction Finding (DF) systems. FIRST RF will produce the modular antenna subarrays and support equipment, including manifolds, cabling, fixtures, etc. Radio integration will be through a prime or directly with the government.

Company Objectives: FIRST RF Corporation is a developer and manufacturer of wideband, lightweight, and modular antennas. The antenna solution for this BLOS concept fits with the company's core business. FIRST RF hopes to fabricate, test, and deliver these modular antennas to primes and government customers.

Potential Commercial Applications: The wideband nature of these modular antennas provides coverage of WiFi frequency bands. These antennas could be used for the creation of hotspots during emergency operations in disaster relief or similar humanitarian aid situations.

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Department of the Navy SBIR/STTR Transition Program

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Topic # N163-140

Curved (Convex) Surface Global Positioning System (GPS) Antenna Design for Submarine Launched Ballistic Missile (SLBM) Trident D5 Flight Test Reentry Bodies
FIRST RF CORPORATION

WHO

SYSCOM: SSP

Sponsoring Program: 0101221N
Joint Warhead Fuze Sustainment
Program: Project 0951

Transition Target: Reentry vehicles

TPOC:

SSP.SBIR@ssp.navy.mil

Other transition opportunities:

Launch vehicles, hypersonic vehicles, munitions, etc. for NASA, MDA, Air Force SMC, and private industry.



<https://www.public.navy.mil/subfor/underseawarfaremagazine/issues/arc>
and Image Courtesy of FIRST RF Corporation

WHAT

Operational Need and Improvement: Navy reentry flight test vehicles need the capability to capture GPS data during flight. Currently a flat plate is used in order to mount the antenna and simplify the design. To be more representative of an actual reentry vehicle, which has a rounded surface, using a rounded cover for the GPS antenna in a flight test vehicle is desired.

Specifications Required: The antenna design must accommodate both the L1 and L2 GPS frequencies and must accommodate both the C/A and P(Y) codes. The antenna design will need to handle high temperature, temperature shock, vibration, etc. for the reentry environment.

Technology Developed: FIRST RF has developed a curved surface GPS antenna and array with better performance than legacy options. The new antenna has higher efficiency to obtain greater link margin, and this provides telemetry data over a greater portion of the flight path. The antenna has greater bandwidth to allow for frequency shifts due to the extreme temperatures encountered, while still retaining the full GPS spectrum in the passband of the aperture. Finally, the simple structure and assembly provides increase reliability for greater probably of mission success.

Warfighter Value: This new curved GPS antenna would allow the use of GPS receivers in additional Navy reentry flight test vehicles and could reduce the effort used to recreate a trajectory after flight. The improved reliability enhances the effectiveness of the testing activity, and the performance improvements (bandwidth and gain) provide telemetry data for a longer portion of the flight profile. Since the new curved GPS antenna has reduced mass, there is a benefit to air forms of Navy reentry flight test vehicles.

WHEN

Contract Number: N00030-20-C-0205 **Ending on:** November 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I	N/A	Antenna gain and pattern measurements	4	October 2017
Phase I Update	N/A	Antenna gain and pattern measurements	4	August 2018
Phase II Baseline Program	N/A	Antenna gain and pattern measurements	5	November 2021

HOW

Projected Business Model: FIRST RF is a product oriented company developing advanced technologies for antennas and Radio Frequency (RF) systems including communications, radar, phased arrays, Point Navigation and Timing (PNT), RF compatibility, low observable antennas, Electronic Warfare (EW), and Direction Finding (DF) systems. FIRST RF will produce GPS antennas in an array configuration for integration into Navy reentry flight test vehicles. The integration will be through a prime or directly with the government.

Company Objectives: FIRST RF is a key developer of high temperature antennas for high speed platforms. This GPS antenna fits with FIRST RF Corporation's desire to support antennas for the rugged environments of Navy reentry flight test vehicles. The goal of this project is to produce, test, and deliver GPS antennas for conformal use on Navy reentry flight test vehicles.

Potential Commercial Applications: Commercial launch vehicles need GPS antennas to monitor position during launch. The harsh environments experienced during both launch and recovery make these high-temperature antennas useful.

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NAVAIR 2021-81

Topic # N181-007

Robust Communications Relay with Distributed Airborne Reliable Wide-Area Interoperable Network (DARWIN) for Manned-Unmanned Teaming in a Spectrum Denied Environment

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 266

Transition Target: PEO U&W

TPOC:

(301)342-6020

Other transition opportunities: F10 provides a network architecture targeted for transition into multiple joint program offices including aircraft, pods, platforms, and applications. Transition targets include: NAVAIR PEO T; NAVAIR PEO U&W; NAVWAR PEO C4I; NAVSEA M/LUSV; USAF ACC; Army SOAR.

Notes: Fuse has unique design processes that incorporate end user input at all stages of development. Fuse design thinking applies the best practices of commercial design with a focus on the warfighter,

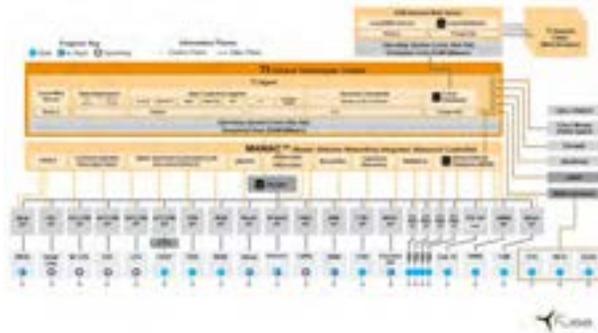


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WHAT

Operational Need and Improvement: Being able to reach back to large data-warehouses or push data or ensure communications at the forward edge. Sensor data from various platforms across a wide geographic region will require the use of a spectrally diverse network that is resilient and can speak multiple machine languages. To execute advanced Integrated Fire Capabilities (IFC) capabilities joint platforms will require access to the network regardless of threat orientation or disposition. The need to be able to bring together disparate message sets, waveforms, and spectrum highlight the crux of the problems that any future objective network will face.

Specifications Required: Design and develop a networked Line of Sight (LOS) communications capability to share high-data rate Intelligence, Surveillance, and Reconnaissance (ISR) data and tactical information between ships and DoD aircraft in local area of operations for distributed operations; to provide communication relay targeting updates for network-enabled weapons; and to move high data rate ISR data back and forth to ground entry points (GEPs) in support of ISR and long-range strike missions.

Technology Developed: Fuse Tactical Edge Network Architecture (F10) consists of Tactical Technologies Toolset (T3), a web-based user interface, and Master Autonomous Network Integrated Advanced Controller with Access Points (MANIAC/AP), and a unified heterogeneous radio controller. The F10 architecture centralizes management of the platform devices and works in a distributed fashion utilizing a Data Plane Optimization Message (DPOM) set derived from CDL (Common Data Link) capstone. This CDL capstone can discover other CDL nodes and establish a network connection without broadcasting high power Ku-band radio frequency. This approach to discovery enhances the ability of the platforms to operate undetected. Through continued development Fuse is working to ensure that F10 complies with Open Mission Systems architecture. Fuse has developed an OMS adapter that provides OMS-compliance with little or no changes to legacy hardware subsystems or software services.

Warfighter Value: F10 improves network performance across platforms which support a multitude of radio links. F10 software manages platforms-of-opportunity to serve as communications nodes managing omni-directional and directional line-of-sight (LOS), and beyond-line-of-sight (BLOS) capabilities. F10 architecture allows for an agility across the radio frequency spectrum with simultaneous use of multiple radios, and a TDL gateway able to push tracks and TDL data back to distributed command center.

WHEN

Contract Number: N68335-19-C-0585 **Ending on:** January 28, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
W Band Architecture	N/A	Defined interfaces between network/modem/antenna	2	TBD
Live, Virtual, & Constructive (LVC) Demonstration	Med	Simulated connectivity between network/modem/antenna	4	TBD
MUDLAN Technical Demonstration 2	Low	Availability of high throughput network	5	TBD
Northern Edge	Med	Joint multi-platform connectivity	6	TBD
W Band Airborne Flight Test	Med	Connectivity between W band airborne nodes	6	TBD

HOW

Projected Business Model: Fuse's balance of experience in operations and systems engineering, blended through our Fuse Process, helps to ensure that the solutions we develop meet the user needs for the environments in which they will be employed. Fuse has developed a software based solution, that is optimized to run on the Fuse CORE® multi-function network controller, but can be licensed to other commercial organizations to run on any system.

Company Objectives: Identify other potential DoD applications for this architecture. Explore opportunities with other agencies/commercial partners that have similar remote/local network management needs.

Potential Commercial Applications: F10 provides an open enterprise architecture that can interconnect a wide variety of links, networks, processors, and sensors with an ubiquitous monitoring and management layer giving warfighters an intuitive capability for control and decision making.

Contact: Rebecca Unetic, Director of Strategy
rebecca.unetic@fuseintegration.com 952.994.3323

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0474

Topic # N161-049

Joint Tactical Radio System (JTRS) Compliant Anti-Jam Waveform for Littoral Combat Ship (LCS) Unmanned Vehicle Beyond Line of Sight
GIRD Systems, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: Littoral Combat Ship (LCS) - PMS 420

Transition Target: MVCS Anti-Jam Sensor Networked Data Link (Transceiver) supporting beyond line of sight (BLOS)

TPOC:
(850)230-7015

Other transition opportunities:
Platforms requiring high throughput anti-jam communications.

Notes: Anti-Jam Networked High Throughput Data Link



Composite Image Created by GIRD Systems

WHAT

Operational Need and Improvement: A critical aspect to the LCS mission is performing mine sweeping with sensors based on remote vehicle. The sensor data is sent to the LCS platform via a data link which is currently susceptible to jamming. The data link being developed provides exceptional resistance to jamming while maintaining the high throughput required. Furthermore, current system LRUs are a DMS (diminishing material source). This data link absorbs that functionality.

Specifications Required: Polymorphic waveform - self mode adaptation to communications environment. Eight (8) modes: 0 through 7. Throughput (Mbps): 0.05 mode 0 to 36 for mode 7. BLOS Relay Mode: The AJ LOS Radio shall support BLOS communications via a relay node with at least one hop. The relay node shall serve as a slave to the LCS and master to downlink slave radio. Frequency diversity shall provide improved SNR performance as the number of channels are increased.

Technology Developed: Advanced waveform providing high throughput, networked over the air connectivity. Provides communications protection in an electronic warfare environment ensuring reliable data links. In addition, the sensor data link being developed incorporates other LRU functionality thus simplifying the overall system.

Warfighter Value: Sensor data link with advanced anti-jam waveform provides the warfighter with high reliability connectivity to critical sensor data (situational awareness). Additionally, the data link incorporates functions from other LRU's such as the antenna controller (which has gone DMS) thus simplifying the overall system.

WHEN

Contract Number: N68335-20-C-0166 **Ending on:** December 31, 1969

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Kick Off Meeting	N/A	Review with technical and contracts	4	March 2020
Program Progress Report	Low	To include system requirements document	4	May 2020
Project Review and System Design Review	Low	Complete Review answer questions	5	August 2020
Demonstration High Throughput AJ	Med	Show reliable communications link in the presence of jamming	5	August 2020
System Demonstration including BLOS Relay	Med	Network discovery performance	7	March 2021
Phase II Option - Award	Low	Complete Seminal Transition Event (STE)	8	May 2021

HOW

Projected Business Model: The GIRD Systems business model is to maintain design cognizance, to manufacture, test, and deliver the product. As the main component (a software defined radio - GDR) is an existing circuit card assembly that has been sold into other programs the manufacturing ramp up will involve the lower risk aluminum housing and front panel. The quantities required of the program/platform are not that high and will not require retooling. GIRD intends to design, develop, produce and sell the data link.

Company Objectives: GIRD Systems company objective is to continue to expand the proliferation of our GDR software defined radio. It has already been delivered into 3 other programs. This target program does have a higher quantity and a higher profile. GIRD Systems leverages its expertise in advanced waveforms to solve difficult customer problems. We wish to discuss this technology with customers who need high throughput, jam resistant data transfer.

Potential Commercial Applications: GIRD Systems market research indicates that the path to the larger commercial market (especially initially) is best served via a partner that already has significant presence. Discussions are already progressing. This includes excellent timing via the 5G rollout.

Contact: Mark Fischer, Senior Program Manager
mfischer@girdsystems.com 513 477-0214

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NAVSEA #2020-0414

Topic # N181-033

IDA: Intelligent Digital Assistant
Intelligent Automation, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS, PEOC4I

Transition Target: AEGIS Combat System

TPOC:
(615)553-9226

Other transition opportunities:



Photo Courtesy of US Navy

WHAT

Operational Need and Improvement: Due to the realities of emerging threats in a more complex operational environment, higher track volumes, and against increasingly technologically-sophisticated adversaries, there is a need to improve watchstander (console operator) reaction time and to ensure operators do not succumb to information overload. The Navy requires a virtual assistant for the AEGIS combat system that will leverage AI algorithms and a suitable modular software architecture.

The assistants will improve team performance by continuously and autonomously monitoring data, executing tasks, and distributing critical information throughout the AEGIS Combat System (ACS). Watchstander performance will be enhanced with customized voice commands and automated responses designed to integrate seamlessly into tactical operations.

Specifications Required: IDA is designed to operate on AEGIS computing infrastructure and will need to integrate with AEGIS Combat System computers, consoles and communications equipment.

The virtual assistant will demonstrate >50% improvement over an unassisted operator (on average) in the number of tracks that the operator can efficiently handle.

Technology Developed: IDA is a highly integrated set of AI enabled services that support tactical operations and mission planning and execution for complex task management. Components include: voice recognition; tailored to mission vernacular; data fusion models; complex workflow construction and data distribution system integrations.

Warfighter Value: Our virtual assistant supports AEGIS watchstanders with AI to reduce VAB and trackball actions by up to 90% and provides critical data with voice commands to improve focus on critical tactical decisions. Our system is highly configurable and ready to support AEGIS and other integrated combat systems, e.g. the Ship Self-Defense System (SSDS), and the Navy's Future Integrated Combat System.

WHEN

Contract Number: N68335-19-C-0753

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop prototype for CDS Console	Med	Demonstrate voice commands and workflows on CDS commercial equivalent console	TRL 4	October 2020
Delivery of Multi-mission capable Prototype	Med	Demonstrate IDA support for multiple mission scenarios across multiple users	TRL 5	November 2021
Seminal Transition Event	High	Successful test event at land based test site	TRL 6	August 2022

HOW

Projected Business Model:

IAI will develop and maintain IDA components and make them available for other tactical and commercial applications through contract engineering and licensing agreements. IDA will be made available to multiple combat systems through integration with CDS operating systems software developed by Leonardo DRS for CDS and other tactical consoles, including those being piloted via the Virtual Pilot Ship program and other efforts to more rapidly deliver combat capability to the Fleet, e.g. the Virtual Twin (VT).

Company Objectives:

Identify AEGIS and other combat system stakeholders to identify opportunities for additional IDA evaluation and integration with combat system components.

Potential Commercial Applications:

IDA's flexible and configurable architecture makes it ideal for integration into other operator terminal applications to assist users with complex tasks such as intelligence analysts, medical personnel, and transportation network managers.

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Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-7504-20

Topic # N182-127

Fooling Computer Vision Classifiers with Adversarial Examples

Lynntech, Inc.

WHO

SYSCOM: ONR

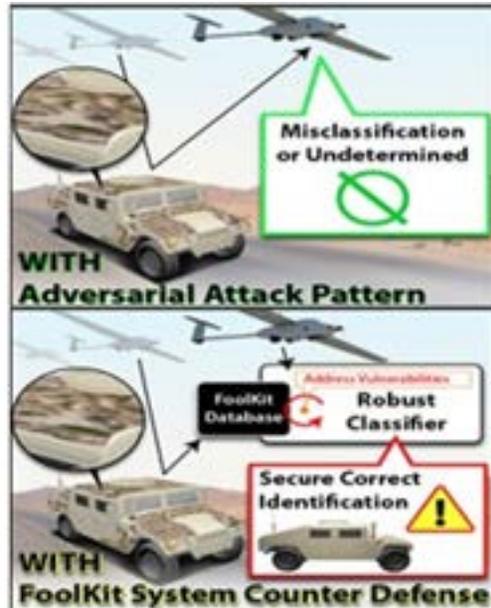
Sponsoring Program:

Transition Target: USMC PEO Land Systems

TPOC:

Dr. Michael Qin
michael.qin@navy.mil

Other transition opportunities: Aerial platforms, ISR, ATR, future UAS



2019 Lynntech Inc.

WHAT

Operational Need and Improvement: The increasing amount of sensor data streams and use of unmanned platforms demands the increased automation of many tasks. However, such intelligent systems have vulnerabilities to evasive manipulations of appearances that can fool them. Deploying and/or countering such Computer Vision Camouflage is anticipated to become a pressing operational need in the near future. As it is developed across the EM spectrum this will likely disrupt the performance of established ISR/ATR systems, demanding more robust computer vision detectors and classifiers as well as counter defenses.

Specifications Required: Synthesize robust and transferable attack patterns for a range of view points for five CV FoolKit variants. Successfully degrade object detection/classification with black-box (unknown) computer vision classifiers.

Develop counter defenses to robust physical adversarial examples.

Technology Developed: Lynntech Inc. has developed its Computer Vision FoolKit technology to provide a form of computer vision camouflage that is tailor-made for making an object of interest evasive in appearance to (semi)-automated ISR/ATR systems that are trained with most machine learning approaches. Lynntech has successfully fooled white box (known) classifiers and has developed rigorous synthesis and evaluation procedures to ensure the effectiveness of our camouflage patterns in black box tests against unknown classifiers.

Warfighter Value: Development of Lynntech's computer vision camouflage will lower the probability of detection by the enemy of U.S. warfighters and their allies. The development of the complimentary counter defense to Computer Vision FoolKit will increase the situational awareness of U.S. warfighters and their allies, keeping them safer and giving them an edge on the battlefield.

WHEN

Contract Number: N68335-20-C-0096 **Ending on:** November 19, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Digital tests of CV FoolKit variants	Low	Decrease known classifier performance in digital realm	3	1st QTR FY21
Lab validation of CV FoolKit variants	Low	Decrease known classifier performance on scale model	3-4	1st QTR FY21
Field tests of CV FoolKit variants	Med	Decrease known classifier performance in field test	4-5	3rd QTR FY21
Design counter defense to CV FoolKit	Med	Evaluate all adversarial patterns	4	4th QTR FY21
Field test prototype camouflage decals	High	Test against unknown classifier	5-6	1st QTR FY22

HOW

Projected Business Model: Lynntech Inc. plans to transition the Computer Vision FoolKit technology by either (i) providing a software as a service (SAAS) to DoD transition partner(s); or (ii) licensing the technology to a defense industry partner(s). The current business strategy is to sell a service or license to an existing defense prime since the base ISR/ATR technology is established, this approach lowers the required investment, it satisfactorily addresses the security restrictions and provides an established customer base.

Company Objectives: Lynntech's objectives for this project are to degrade the performance of state-of-the-art Computer Vision systems as well as develop a breadboard prototype of a counter defense to the FoolKit, and thereby break into the DoD IRS/ATR market. Lynntech is a for-profit small business and believes that if we properly meet the above objectives, sales and profit will follow.

Potential Commercial Applications: Civilian application include providing tools for AI security evaluations unto the development more robust Computer Vision systems for autonomous systems (e.g. self-driving vehicles), industrial inspection, security and the Internet of Things (IoT).

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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0437

Topic # N181-053

Leveraging a Robust Data Architecture for Rapid Combat System Integration, Testing, and Certification

Skayl LLC

WHO

SYSCOM: NAVSEA

Sponsoring Program: NAVSEA PEO IWS 1.0

Transition Target: Government and prime customers who design, deliver, and sustain large, complex, distributed Systems of Systems (SoS) in environments such as fleet management, aviation, UAS, and command and control.

TPOC:

(202)781-3165

Other transition opportunities: Skayl is currently considering the following potential transition targets: NAVSEA NSWC DD CRADA (signed Jan 2020); NSWC Dahlgren PLA Maintenance, Evolution, and Test Strategy Session (Jan 2020); Software and System Integration Architecture Meeting (May 2020); Army CCDEVCOM Integrated Mission Equipment (IME).

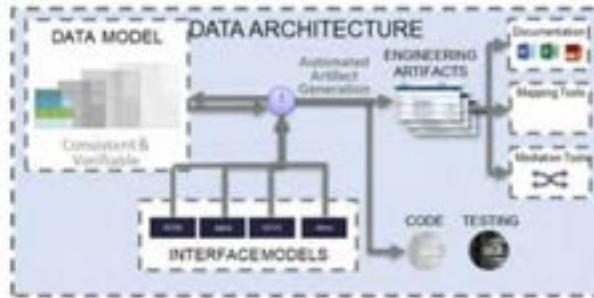


Image Courtesy of Skayl, LLC

WHAT

Operational Need and Improvement: Current integration is powered by repeated labor intensive, error prone human capital. While we can integrate systems-of-systems by hand, we can not execute integration with the precision and velocity required to provide and maintain offset advantage. The Government is in need of:

- Cost-Effective, Performant, Verified Integration Infrastructure
- The ability to Sense, Track, and engage capabilities of Distributed Systems

Specifications Required: Large, complex, distributed, Systems of Systems integration, validation and verification.

Technology Developed: Automated Integration Capability, Model-Based Engineering Tools and Processes, Semantic Data Architecture Driven Software Development Processes, Incremental Certification Capabilities via Formal Methods Based Testing - "Software that Writes Software" providing the ability to:

- Derive statistically complete multi-perspective tests
- Enable model-managed test and infrastructure regression verification
- Generate scalable data validation and input verification software in support of cyber requirements
- Eliminate cyber vulnerabilities early in the development
- Assess impact of local changes and updates on integrated system
- Enable agile software development processes

Warfighter Value: Rapid Fielding and Integration of Warfighting Capabilities and Cyber Updates within and across Combat Systems

WHEN

Contract Number: N68335-19-C-0599 **Ending on:** September 15, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Start of Phase II	Med	Begin development of a configurable and flexible transport service segment that streamlines integration through mediation and protocol bridging.	3	September 2019
Army FACE™ TIM Demo: Rapid Integration	Low	Successful rapid integration and validation demonstration at the Future Airborne Capability Environment (FACE™) Technical Interchange Meeting (TIM)	5	September 2020
Seminal Transition Event (STE)	Med	Adoption of Semantic Model-Based Test and Validation Tools & Processes by IWS and/or Army IME Prime contractors via tools and data model content	5	October 2021
End of Phase II	Med	Commercial application of CinC	6/7	June 2022

HOW

Projected Business Model: Our business model involves licensed access to our infrastructure ecosystem.

Company Objectives: We anticipate the STP program will facilitate further transition and awareness of our technology; provide advice on selling infrastructure and tooling vs. a product (and how this fits into procurement steps, and market research to identify program timelines and decision-makers for which our tools could be valuable.

In the short-term, Skayl is looking to transition this SBIR technology in at least two Phase III's. Immediate targets include the Product Line System Engineering team at NSWCDD supporting IWS 1.0 and the Army's CCDEVCOM Integrated Mission Systems program.

In the long-term, Skayl plans to automate integration, testing and verification across other industries in mission critical applications such as the medical, public safety and power industries. We will incorporate this SBIR's results into our ecosystem of configurable infrastructure and advanced data model manipulation tools to streamline the recertification of evolvable infrastructure.

Potential Commercial Applications: With increasing proliferation of and reliance on large, complex and distributed SoS, this technology has vast potential commercial applications. In particular, mission critical applications with stringent certification and verification requirements are ideally suited for the technology. Potential transition targets include aerospace, medical devices, and smart city IoT applications such as public safety, traffic management, and power.

Contact: Sonya Hand, Director of Marketing and Strategy
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Cyber

(Navy FST Booth: 2 August)



Company	Topic	Project Title
La Jolla Logic, Inc.	N132-140	Cognitive Autonomous Artificial System Intelligence (CAASI)
Real-Time Innovations	N171-050	Software-based Modular and Extensible Cybersecurity Framework for Combat Systems
TDI Technologies, Inc.	N16A-T013	CYBER FORENSICS TOOLKIT (CyFT)

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0364

Topic # N132-140

Cognitive Autonomous Artificial System Intelligence (CAASI)

La Jolla Logic, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: NAVSEA (SEA-O3) - Cyber Engineering and Digital Transformation Directorate

Transition Target: U.S. Fleet Cyber Command (FCC)/U.S. TENTH Fleet (C10F)

TPOC:
(202)781-3623

Other transition opportunities:

Within the Defense sector, CAASI would benefit the cybersecurity detection capabilities within NAVAIR and NAVFAC platforms and industrial control systems. As CAASI evolves it is broadly applicable to any computer network system for the detection of unknown anomalous activity including potential security threats and indications of deteriorating mechanical system performance.

Notes: Cognitive Autonomous Artificial System Intelligence (CAASI) augments existing malware detection tools through its ability to detect previously unknown threats. By continuously monitoring and analyzing network connections, CAASI learns the normal patterns and characteristics of a network. Using its learned knowledge base, CAASI is able to detect and isolate suspect activity for further analysis.



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WHAT

Operational Need and Improvement: The global cyber threat is continuously evolving. The emergence of state-sponsored malicious actors in the cyber domain magnifies the threat to Department of Defense networks, weapons systems, and platforms which are increasingly connected to take advantage of synergies in netcentric operations. Cyber defense must evolve with the threat and be capable to detecting and countering hostile actions before they can cause damage. New capabilities are needed to protect the confidentiality, integrity, and availability of defense systems in the contested cyber environment.

Specifications Required: Use of inference engine technology to adapt to new threats, increase cyber security situational awareness, and reduce analyst response times.

Technology Developed: La Jolla Logic has developed a high-velocity data ingestion engine, unsupervised machine learning techniques, and abnormal network behavior detection algorithms to identify potentially malicious activity, whether from direct hack attempts, viruses, bots, or even insider threats. CAASI also models system interactions and interconnectivity which has many benefits in addition to attack detection. Understanding the orchestration of communication between systems on a network can provide survivability on which other systems would be affected if one particular system were to be compromised or to fail.

Warfighter Value: CAASI adds a new capability to existing cyber security tools through its anomalous behavior detection. Unlike existing cyber security detection tools, CAASI does not rely on libraries of known malicious code like traditional antivirus libraries. Instead, CAASI learns and understands normal system behaviors enabling it to seek out previously unknown threats. Simply stated, CAASI has the ability to detect zero-day attacks on a network, drastically limiting the ability of malware to propagate and compromise complex Industrial Control System (ICS) networks.

WHEN

Contract Number: N68335-19-C-0204 **Ending on:** September 8, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Baseline Integrated CAASI System	N/A	Established laboratory environment and developed prototype into integrated system with baseline visualization functionality to enable testing in relevant environment.	TRL 5	September 2019
Data Ingestion and Analysis	N/A	CAASI successfully ingested 5 TB of recorded network traffic and established learned database.	TRL 5	April 2020
Attack Detection Test & Analysis	N/A	Validated algorithms achieve very high attack detection with very low false positive rate in realistic laboratory environment.	TRL 6	July 2020
If Phase II Extension exercised, Navy Test Event	Low	Integration with NAVSEA cyber security tool suite and realistic test event within a Navy environment.	TRL 7	March 2021

HOW

Projected Business Model: Leverage DoD SBIR funding to address technology risk in development for direct sell to the government which is acting as lead integrator for primary target program. Provide ongoing support to integration into cyber security tool set for application aboard all afloat platforms. Long term, business model includes IP protection and tailored development for application in the commercial market through use of company-funded internal research and development (IR&D).

Company Objectives: Seek additional DoD programs that will benefit from CAASI's cyber security intrusion detection capability to extend adoption across multiple defense networks. Identify potential programs developing condition-based maintenance applications that may benefit from CAASI's identification of anomalous network activity on industrial control networks. Develop a Commercial off the Shelf (COTS) product for application in cyber defense of Critical Infrastructure networks such as Energy Sector/Utilities and in the Financial Sector.

Potential Commercial Applications: CAASI technology is directly applicable to cyber security of any network as a compliment to existing threat detection systems. It can also be adapted with little effort to specific use within Critical Infrastructure systems such as public water distribution and energy sector utilities to analyze detected anomalies and score indicators that a system was acting abnormally and may be about to fail. CAASI's ability to detect abnormal behaviors on industrial control systems can be applied to inform condition-based maintenance models to improve accuracy and reliability of predicted failures.

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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0386

Topic # N16A-T013

Cyber Forensic Tool Kit for Machinery Control
TDI Technologies, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO Ships

Transition Target:

TPOC:

Other transition opportunities: Any platform vulnerable to Cyber attacks including any platform with SCADA Machinery Control Systems (MCSs): Ships, submarines, manufacturing facilities. Land or sea-based C4ISR systems.

Notes: Phase-II Option I was originally scheduled to end on 06/13/2020. Due to changes in work schedule and meetings from COVID-19, the project is currently under a No Cost Extension till 12/13/2020. Awaiting the next round of funding taking us into Phase-II Option-II, which will be the last year of performance.



https://www.navy.mil/view_image.asp?id=69987

WHAT

Operational Need and Improvement: Navy Machinery Controls Cybersecurity domain needs a solution with state of the art technology to defend against ever-evolving cyber threats. Vendor-locked proprietary solutions (both HW and SW) hinder the ready integration of existing cyberforensics solutions. Unique requirements of legacy and proprietary hardware (field devices) and software (OS, applications, comms protocols), within SCADA/DCS systems necessitate the development of an open architecture design in order to functionally test various tool components to be integrated into the CyFT framework.

Specifications Required: 1. Design Alternatives Modular vs Integral; 2. Solution Architecture Closed vs Open; 3. API Specifications Open Standard vs Custom; 4. Evaluation Models Formal/Abstract vs Simulation/Prototype; and 5. Tool Execution Memory Resident (e.g., Terminate & Stay Resident (TRS)) vs Disk Resident.

Technology Developed: Open Systems Architecture-based Cyber Forensics Toolkit (CyFT) Framework that is portable, lightweight and modular that allows the user plug-in support to live/memory forensics. This method allows for use on legacy systems without the need for expensive and time consuming hard/middle/software changes.

Warfighter Value: Incorporation of the Cyber Forensic Toolkit in the existing PLC helps alleviate future incidents and provides a real-time solution to combat cyber threats. This cost conscious tool saves the government time and money in assessing gap vulnerabilities and link to patches. This portable, lightweight solution does not require on site IT support staff.

WHEN

Contract Number: N68335-18-C-0282 **Ending on:** December 13, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
PLC/field-device memory acquisition and analysis	Low	Remote dump of PLC/field-device memory	6	April 2020
Inject malware (static-memory-exploits) into running PLC processor board	Med	Detection of malware in static memory	6	June 2020
Man-in-the-middle packet injection attack/detection	Low	Detection of altered command in memory	6	July 2020
Correlation of raw traffic and memory dump for malware analysis	Med	Link malware in raw traffic to malware in memory	5	December 2020
Inject malware (dynamic-memory-exploits) into running PLC processor board	Med	Detection of malware in dynamic memory	5	January 2021
Traffic and memory analysis using eBPFs	High	eBPF tools deployed on running system(s)	4	March 2021

HOW

Projected Business Model: Licensing software to various original equipment manufacturers and to be integrated into the program.

Company Objectives: TDI Technologies offers its customers technology-driven solutions focused around core competencies in research and development, cybersecurity, software development and engineering, and engineering services. TDI's objective is to meet with Program Managers in PEO Ships and Tech Warrant Holders at SEA 05 as well as system integrators to demonstrate how the tool kit defines and develops security and cyber-forensics ontologies that prevent future cyber threats by integrating CyFT in existing machinery-controls. This eliminates the need for expensive machinery-control recapitalization or purchasing proprietary information. TDI intends to exhibit this open architecture capability at government/industry sponsored events. TDI will license and support CyFT by leveraging commercialization in the automotive, energy and pharmaceutical industries to drive down the cost to the government.

Potential Commercial Applications: In addition to the current military application, this technology is applicable to cyber physical systems broadly spanning the domains of Transportation and Energy, with possible applications to Environment and Pharmaceutical industries. Current prime contractor, Fairmount Automation will be testing this technology in various machinery systems.

Contact: Dr. Avinash Srinivasan , Director - CyberOps & Forensics Solutions; Ph.D., CEH, CHFI
avinash@tditek.com (484) 473-1877

Electronic Warfare (Navy FST Booth: 2 August)



Company	Topic	Project Title
HYPRES. Inc.	N17A-T027	Energy Efficient, Non-Silicon Digital Signal Processing (DSP)
Phase Sensitive Innovations, Inc.	N182-101	Multicore Fiber Optic Package Optical Subassembly for Wideband Digital and Analog Photonic Links

Department of the Navy SBIR/STTR Transition Program

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Topic # N17A-T027

Energy Efficient, Non-Silicon Digital Signal Processing (DSP)

HYPRES. Inc.

WHO

SYSCOM: ONR

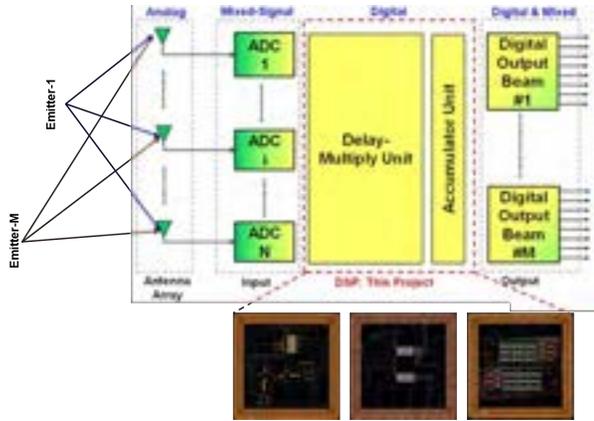
Sponsoring Program: Code 312: Cryogenically Enabled Electronics Technologies for Mixed Signal Systems

Transition Target: Surface Electronic Warfare Improvement Program (SEWIP)

TPOC:

Dr. Deborah VanVechten
deborah.vanvechten@navy.mil

Other transition opportunities:



WHAT

Operational Need and Improvement: Dominance over the entire electromagnetic spectrum spanning the entire three-dimensional space.

Specifications Required: Digital true-time-delay beamforming components operating at clock frequencies exceeding 40 GHz to maintain compatibility with RF digitizers with the same sampling frequency

Technology Developed: Superconductor Microelectronics: Ultrafast Digital Signal Processor
 Precise programmable digital true-time-delay
 Spatial filtering and beamforming
 Serial-biasing technique for Rapid Single Flux Quantum (RSFQ) logic, an enabler for all digital processing applications such as image processing, and computing.

Warfighter Value: Precise location of RF emitters over the entire electromagnetic spectrum

WHEN

Contract Number: N68335-18-C-0654 **Ending on:** August 6, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop Digital Programmable Delay	Low	IC measurement results of proper functionality and speed	5	2nd QTR FY21
Develop Multiply Unit	Med	IC measurement results of proper functionality and speed	5	2nd QTR FY21
Develop Digital Decimation Filter	Med	IC measurement results of proper functionality and speed	5	2nd QTR FY21
Develop Inter-island Interface for Serial Biasing Digital Circuit Blocks	High	IC measurement results of proper functionality and speed	5	2nd QTR FY21
Implement Digital Beamforming Circuitry	High	IC measurement results of proper functionality and speed	5	3rd QTR FY21

HOW

Projected Business Model: Augment Advanced Digital-RF Receiver (ADR) with new chipset having multiple ADCs and the new DSP. Market DSP-enabled ADR for EW (and other) applications requiring multi-beam receive capability.

Company Objectives: Develop digital-RF receivers for the military market

Potential Commercial Applications: Fast digital data processing and computing for data centers

Contact: Dr. Deepnarayan Gupta,
dgupta@hypres.com +1-914-980-3792

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-724

Topic # N182-101

Multicore Fiber Optic Package Optical Subassembly for Wideband Digital and Analog Photonic Links

Phase Sensitive Innovations, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO (T), PMA 234

Transition Target: Airborne Electronic Attack Systems

TPOC:

(301)342-4122

Other transition opportunities:

Potential applications of a balanced detection IMDD link includes: a) Millimeter wave wireless telecommunications; b) Long haul antenna remoting; c) Phased array antennas (AESAs, SPY-1)

Notes: The wide applications of analog photonic links is limited by their cost and reliability concerns and mostly by their noise and linearity performances. The successful development of the balanced detection IMDD link will remove these limitations by substantial improvements on the link NF and linearity. High link output power and high linearity become indispensable backbone technology for tomorrow's 5G communication and high frequency signal generation using photonic approaches.



<https://www.navair.navy.mil/product/ALQ-99-Tactical-Jamming-System>

WHAT

Operational Need and Improvement: Bulky, heavy, EMI-susceptible metal cables in today's war fighter not only raise SWaP concerns and also limit the system bandwidth due to high RF loss at elevated frequencies or over long distance. As a comparison, optical fibers are nearly lossless in transporting RF signals, very light and inherently immune to EMI. Replacing metal cables with RF photonic links can significantly improve the system SWaP and bandwidth but is currently limited by link NF. A broadband, low NF, high dynamic range RF photonic link is therefore highly demanded in tomorrow's avionic and marine platforms.

Specifications Required: The program objective is to develop two-core-, multicore-, fiber optic-based analog and digital links consisting of a DFB laser, a dual-output modulator and a balanced photo detector. The link specs include: 1) >100m two-core, multicore, single-mode fiber; 2) low optical insertion loss (~0.75dB), low return loss (~30dB) and low optical crosstalk (~40dB); 3) 10MHz – 45GHz link bandwidth; 4) >200mW input power for the dual-output modulator. Good path length matching over long distance and broad bandwidth as well as high laser relative intensity noise (RIN) rejection shall be demonstrated by developing and prototyping a high gain, low NF and high dynamic range balanced detection link. Thermal shock and temperature cycling studies are required to verify optical subassembly performance.

Technology Developed: Based on our industry leading low Vpi modulator and high-power photodiode technologies, PSI is developing a low-Vpi, high-extinction ratio dual-output modulator and a high-linearity balanced photodiode that can be integrated to a multicore fiber cable. Hermetic, ruggedized component packages and a plug & play link prototype will be delivered towards the end of the phase II effort.

Warfighter Value: The modern warfare environment has become a vast "information highway," where communication, radar, surveillance and electronic support all compete for available bandwidth. Broadband connection between different subsystems enables today's warfighter for higher speed, better sensitivity, larger dynamic range, etc. In addition, fiber links significantly improve warfighter's payload by replacing the heavy, bulky metal cables and reduce warfighter's susceptibility to high-power microwave (HPM) attacks.

WHEN

Contract Number: N68335-20-C-0295 **Ending on:** March 15, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop dual-output MZM package	Med	Dual-output MZM with <4V half wave voltage and ~30dB extinction ratio	6	September 2021
Develop BPD package	Low	20GHz BPD with >0.5 A/W responsivity and >30dB CMRR	6	September 2021
Develop long MCF for link demo	Low	~100m MCF fiber with >35dB isolation between cores	4	June 2021
MCF-based BPD link demo	Low	20GHz broadband link with <20dB link NF using link prototype	4	March 2022
Ruggedized link prototype	Med	Ruggedize link prototype to meet relevant military specs	6	March 2023

HOW

Projected Business Model: PSI's goal is to integrate and transition this technology into government and prime contractor systems for upgrading current system's bandwidth, NF, SWaP and reliability. Under several government fundings, PSI is building our own nanofab, packaging and characterization labs. We are planning to reach MRL 6 for component chip and package manufacturing in 2 years. PSI will also work with our existing prime customers to insert this technology into their systems.

Company Objectives: PSI is improving the dual-output modulator and balanced PD design and fabrication for improved bandwidth, efficiency and power balance and will acquire a long MCF sample to study their length matching properties in controlled environment for potential platform deployment. Integration of both the BPD and the dual-output MZM will focus on maintaining and improving the system balance and noise rejection capability. An MCF-based balanced detection IMDD link prototype using fully packaged components will be demonstrated in the phase II effort to meet the required link specs. PSI's goal is to integrate and transition this technology into government and prime contractor systems for upgrading current system's bandwidth, NF, SWaP and reliability.

Potential Commercial Applications: There are tremendous market demands for high-performance RF photonic link in both DOD and commercial markets. Replacing heavy, low-bandwidth and expensive coaxial cables with light, broadband fibers is widely demanded for antenna remoting, high-speed communication and phased array in many avionic and 5G systems. Low NF RF photonic link is also the fundamental building block for essentially all analog photonic systems.

Contact: Peng Yao, Principal Investigator
yao@phasesensitiveinc.com (302) 286-5191

Company	Topic	Project Title
Beacon Interactive Systems	N171-071	Plug-and-play Analytical Framework for Distributed Structured and Unstructured Data Sets for Condition Based Maintenance Plus (CBM+)

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0412

Topic # N171-071

Plug-and-play Analytical Framework for Distributed Structured and Unstructured Data Sets for Condition Based Maintenance Plus (CBM+) Beacon Interactive Systems

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO SHIPS | SHIPS AM | Bridge Integration

Transition Target: NAVSEA GENISYS Program

TPOC:

Other transition opportunities: The SEAS+ Digital Sustainment Platform provides insight and actionable intelligence for Industrial organizations. Land-based industrial facilities like Shipyards and Maintenance Depots

have the same need to know current state and capacity of their equipment, people and operating conditions in order to make informed Repair & Maintenance decisions. Likewise, these same organizations need the comprehensive operating picture across the enterprise to enable informed and relevant make/buy decisions in terms of Operational Reliability, Sustainability & Resiliency.

Notes: Beacon is well known for actively engaging with our customers; learning from them what is needed to digitally transform their operations. User-centered design is at the core of all Beacon development efforts. By decoupling point-of-performance needs of sailors on the deckplate or the CO on the Bridge from traditional stovepiped resourcing, Beacon has repeatedly delivered Mission Critical systems that drive efficiency, increase safety and improve operations. Furthermore, by working alongside our Navy customers with an Agile Development methodology, Beacon has successfully deployed multiple SBIR incubated shipboard digital systems across the Navy. These products include eTagOut, the electronic tag-out system; eLogBook, digital shipboard logs; and SEAS, the Shipboard Energy Assessment System.



DoD OSBP Video: Beacon SBIR Success Story

WHAT

Operational Need and Improvement: In order to make well informed decisions and ensure Operational Readiness, it is critical to maintain visibility across Readiness Assets. Ship operators and maintainers greatly benefit from a system that provides real-time visibility across all existing assets. SEAS+ integrates information, both structured and unstructured data, from across multiple stovepiped systems and people into a single actionable digital platform.

Specifications Required: Conforms to Navy Technology Roadmaps for Microservices & Containerization; Aligns with Active Navy Shipboard Technical Architecture; Leverages Current Bridge System Authority to Operate (ATO) for SEAS; and Directly Supports OPNAV C2C24: Compile to Combat in 24 hours.

Technology Developed: The technology for this topic is a plug-n-play digital architecture consisting of a base technology layer that enables add-on applications to address specific customer needs. SEAS+ is a second generation digital system that extends the existing shipboard Energy C2 capabilities of SEAS into a Plug-n-Play architecture for Shipboard Readiness calculations beyond Operational Energy. Using Industry standard microservices and containerization, SEAS+ enables the delivery of highly targeted apps, both Beacon and third-party apps, that leverage disparate data sources and algorithms to provide an enhanced digitally informed Bridge and Watchstander experience.

Warfighter Value: Actionable Intelligence; Comprehensive Operational Visibility; Streamlined Safe Performance of Maintenance; AI Informed Decision-Support at the Point-of-Performance; Increased Days on Station; Lightened Logistics Load; Continuously Informed Shore-based Sustainment Efforts; Operationally Informed S&T Programs; Improved Mission Readiness & Operational Resiliency

WHEN

Contract Number: N68335-20-C-0157 **Ending on:** December 3, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Concept Design	N/A	Design Documentation	TRL 3	May 2020
Architecture Design	Low	Design Documentation	TRL 5	December 2020
Application as a Microservice	Low	Data Flow Successful	TRL 5	February 2021
Final Demonstration	Med	Containerized Apps Using Microservices & Micro Frontends	TRL 6	December 2021
Program Transition	Med	Technology Integration with NAVSEA GENISYS Program	TRL 7	December 2022

HOW

Projected Business Model: The business model for the advancement and transition of this Digital Sustainment Platform is a combination of license and services for both defense and industry application. The platform can be hosted in the Cloud or installed onsite locally. Implementation includes not only the base technology but add-on applications for specific customer needs. As part of the services provided with the platform, Beacon will work with customers to ensure data integrations to existing legacy systems.

Company Objectives: Identify additional partners and customers to both scale the existing offering across defense and industry organizations as well as to identify new opportunities for engagement.

Potential Commercial Applications: This Digital Sustainment Platform has wide applicability in many different commercial applications where data can support Readiness and Decision-making. The technology is an Industrial "App" store with dual-purpose defense and industry applicability. The highly flexible deployment and data integration capabilities of this platform are optimized to benefit organizations with high value assets and mission critical need to consistently and reliably operate. Beyond Navy shipboard use, defense applications include shipyards, maintenance depots and forward operating bases. Private sector applicability includes areas such as aviation, transportation and manufacturing.

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Company	Topic	Project Title
NALAS Engineering Services Inc.	N16A-T021	High Performance Energetic Propellant Ingredient Process Research and Development
Plasma Processes, LLC	N131-071	Coating Solutions for Hypersonic Projectiles
Product Innovation and Engineering L.L.C.	N162-087	Onsite Structural Restoration Methods for Aircraft Components
Product Innovation and Engineering L.L.C.	N181-028	Precision Machining of Composite Structures

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-7504-20

Topic # N16A-T021

High Performance Energetic Propellant Ingredient Process Research and Development

NALAS Engineering Services Inc.

WHO

SYSCOM: ONR

Sponsoring Program: PEO IWS; LCS Surface Warfare Mission Package; Hellfire

Transition Target: Low energy exploding foil initiators (LEEFIs) used in AIM-9X, RAM, ESSM, Standard Missile, Spider, FBM ordnance, FMU-139 Product Improvement Program, MEMS Distributed Initiation Systems, and SECAT Advanced Lightweight Torpedo Program.

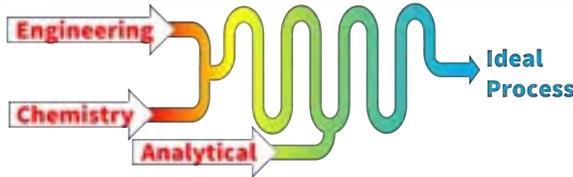
TPOC:

Dr. Chad Stoltz
chad.stoltz@navy.mil

Other transition opportunities: Nalas novel synthesis development efforts aim to significantly reduce the cost of CL-20 to enable adoption of CL-20 in high performance explosive and propellant applications. Navy thrust areas for energetic materials include high performance rocket propulsion and explosives to provide increased lethality with smaller warheads. As such, Programs of Record such as PMA-201 Precision Strike Weapons (Hellfire warheads), PMA-242 Direct & Time Sensitive Weapons (Hellfire propellant), and PMA-259 Air-to-Air Missile Systems (AIM-9X) may incorporate CL-20 as well. These areas of interest extend to the other services in the DOD as well.



Home of Advanced Manufacturing of Critical Materials



WHAT

Operational Need and Improvement: To meet the needs of the future US military services, there is an ongoing need for the development of new energetic materials with higher performance and decreased sensitivity to thermal threats and physical shock and impact. Currently used energetic molecules have been in use for decades with little improvements in sensitivity and/or performance. CL-20 is the most powerful explosive compound ever produced and as such has long been in demand due to its high energy density. Although it was initially developed in the 1980s with subsequent decades of investigation into possible low-cost synthetic routes, its production remains prohibitively expensive for most propellant and explosive applications. Nalas' innovative solution to this cost challenge is the assembly of a precursor from low cost materials that can be converted directly to CL-20 without any further synthetic steps.

Specifications Required: The Navy is seeking energetic ingredients whose energy output exceeds HMX and with superior safe handling characteristics. In order for the energetic ingredient to transition, the route to manufacture it needs to have a minimal number of steps and inexpensive starting materials and reagents. The Navy desires the energetic ingredients to have a density greater than 1.8 g/cc, oxygen content greater than CO balance upon detonation, melting point >200°C, low vapor pressure, sensitivities better than TNT, low hydrogen & carbon and high oxygen & nitrogen content.

Technology Developed: Nalas's efforts on a novel synthesis route for CL-20 have focused specifically on cost reduction. With future continuous improvements, Nalas can drastically reduce the costs to generate CL-20. Nalas utilizes in-house expertise in chemistry, chemical engineering, process development, reaction kinetics and modeling, and process safety to not only develop a synthesis process but also develop predictive reaction models. These reaction models enable safe and expedient scale-up and transition to full scale manufacturing.

Warfighter Value: A low-cost CL-20 will finally enable true development and acquisition of propellants, such as solid rocket motors, that can fly faster and farther than current state of the art propellants. Also, this CL-20 can gain warheads up to 20% more explosive power without adding size or weight to a weapon system. All of this ties into the priorities of the Navy and DoD to regain military overmatch over our adversaries and ensure the safety of our warfighters.

WHEN

Contract Number: N68335-18-C-0027 Ending on: April 30, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Optimization of intermediate synthesis	High	Low-cost route to penultimate CL-20 intermediate	3	4th QTR FY20
Intermediate isolation development	Med	Isolation of high purity	3	1st QTR FY21
Preparation of multi-gram quantities of CL-20	Low	Conversion of novel intermediate to CL-20 in high yield	4	1st QTR FY21
Generate conceptual commercial process	Low	Provide estimate ROM cost of CL-20 manufacture less than SOTA	4	2nd QTR FY21
Characterization of CL-20 by LLNL	Low	High purity epsilon-CL-20 meeting specifications	4	3rd QTR FY21

HOW

Projected Business Model: Nalas is considering becoming a manufacturer of CL-20 and are looking into the logistical steps required to do so. Nalas plans on being the manufacturer of the chemical precursor to CL-20. Recently Nalas purchased a 75,000 sqft facility for the purpose of manufacturing critical chemicals for the DoD starting with the continuous manufacture of the energetic plasticizer BDNPA/F. Nalas began work on developing the continuous BDNPA/F process in an Army SBIR program. Subsequently, the promising results led to further Army investments to help advance the technology to the point of being ready for production and qualification of the material. Nalas intends to follow similar paths for other DoD chemicals, including CL-20 precursors.

Company Objectives: Nalas Engineering's objective for this project is to develop the novel manufacturing technology to provide a dramatically reduced cost CL-20 and to be the manufacturer of the CL-20 intermediate. Beyond CL-20, the mission of Nalas is to support our DoD customers with chemical process engineering and to be the premier transition agent for scaling novel chemistries. Our vision also includes being the preferred manufacturer and supplier of specialty critical chemicals for the DoD. Our manufacturing plans rely on our ability to develop modern, affordable, safe and environmentally-acceptable processes to provide a long-term solution to the US government's problem of lost or reduced US manufacturing of critical energetic materials. By having multiple revenue-generating product lines, Nalas will help secure the critical energetic material supply chain for the US government.

Potential Commercial Applications: Detonators for oil and gas exploration and mining as well as high performance commercial propellants.

Contact: Dr. David Price, Director of Business Development
david.price@nalasengineering.com (423) 212-3247

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-7504-20

Topic # N131-071

High Density, Multi-Layered Nosedtips for Hypersonic Projectiles
Plasma Processes, LLC

WHO

SYSCOM: ONR

Sponsoring Program:

Transition Target: High Velocity Projectiles

TPOC:

Dr. Eric Wuchina

eric.wuchina@navy.mil

Other transition opportunities:

Hypersonics, Long range Munitions

Notes: A system representative nosetip configuration was tested in a simulated flight environment using an arcjet with an example run displayed in the image above. Note the nosetip maintaining a smooth radius during test.



Copyright 2020, Plasma Processes LLC

WHAT

Operational Need and Improvement: Development of high-speed weapons systems for long-range surface fire support, missile intercept and conventional prompt global strike applications is of interest to the Navy.

Specifications Required: The nosetip will require a small nose radius to minimize drag, be of sufficient density in order to balance the center of gravity, handle extreme heat loads in highly oxidizing conditions, survive >30kG axial mechanical loads, >10kG transverse balloting loads, and thermal shock from surface temperature rise of 2000C/sec.

Technology Developed: This effort developed a novel coating solution to provide oxidation protection to high density nosetips utilized for high velocity projectiles. The program also developed an innovative test methodology to test the technology in a relevant environment.

Warfighter Value: This technology will enable surface fire support range and velocity increases.

WHEN

Contract Number: N00014-15-C-0050 **Ending on:** April 30, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Component Testing in a Representative Environment	N/A	Post-test sample evaluation	5/6	3rd QTR FY19

HOW

Projected Business Model: Plasma Processes will serve as a coating service provider for this technology.

Company Objectives: Plasma Processes strives to be an industry leader in providing coating solutions for extreme environment applications. Plasma Processes seeks to transition this technology to a long range munition or hypersonic program of record.

Potential Commercial Applications: Plasma Processes multi-layered technology is applicable to leading edges of hypersonic vehicles, rockets nozzles, combustion liners, jet vanes, and other applications that may experience extremely high thermal gradients.

As such, it is suitable for transition to the commercial rocket and related aeroengine applications and will enable low-cost access to space. In addition, this technology utilizes fabrication methods that enable advanced component designs and have the potential realizing significant cost savings when compared to existing state of the art materials systems.

Contact: Tyler Kaub, Program/Materials Engineer
tkaub@plasmapros.com 256-851-7692

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-870

Topic # N162-087

Onsite Structural Restoration Methods for Aircraft Components

Product Innovation and Engineering L.L.C.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO (A)

Transition Target: PMA-276, H-1 USMC Light/Attack Helicopters

TPOC:
(301)757-9639

Other transition opportunities:

Fleet Readiness Centers (FRC)
Primes – Boeing, Bell Helicopter, GKN, and Toyota

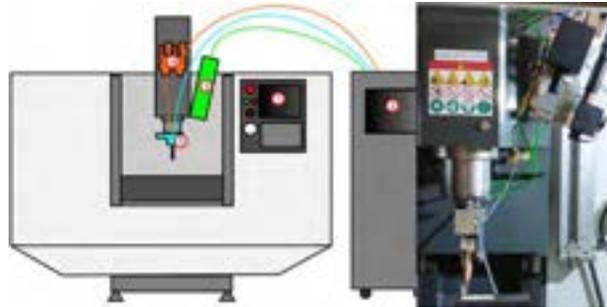


Photo Courtesy of Product Innovation and Engineering (PINE) An illustration showing the general layout of the major items in the repair system: 1. CNC; 2. Deposition Controller; 3. Optics assembly; 4. Powder feeders; 5. Powder tool with photo of items 3,

Notes:

CW – Continuous Wave
AM – Additive Manufacturing
PC – Personal Computer
CAM – Computer Aided Manufacturing
CNC – Computer Numerical Control
DED – Directed Energy Deposition
FPGA – Field Programmable Gate Array

WHAT

Operational Need and Improvement: Aircraft designed for today's Navy are being pressed into service beyond their design life resulting in an increase in failure rates of parts. There is a need for precise and effective methods for full dimensional and strength restoration of aircraft components to reduce the Total Life Cycle Cost and improve Operational Availability of Navy aircraft.

Specifications Required: The system is to repair metallic aircraft components. Repairs generally include blending away damage until the surface is smooth to reduce stress risers that may cause fatigue cracking. By blending, repaired components are left with a lower thickness in the repair location which reduces the ability for future repair capability. The restoration method should result in a component with the same strength capability as an original non-damaged component. In addition, the resulting restoration method should be environmentally friendly, not require the use of hazardous materials, and should not generate or require the disposal of hazardous wastes, such as chromate containing primers and coatings.

Technology Developed: The repair system consists of three primary subsystems:

1. The additive controller includes two powder feeders, a high power CW laser, a q-switched pulse laser, a FPGA for timing-critical control actions, and a PC for on-board CAM, simulation, and managing connectivity to external devices such as cameras or spectrometers;
2. A third party motion system to execute the part program and carry out investigatory probing;
3. An end effector for delivering the combined laser beams and powder stream at a fixed point in space.

AM repair software integrates inspection, CAM, and simulation.

Warfighter Value: The Repair System developed by PINE:

- Reduces Maintenance Costs
- Improves Operational Availability
- Extends Life Cycle Costs of Airframe
- Utilizes Additive Manufacturing

WHEN

Contract Number: N68335-18-C-0603

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Powder Feed Subsystem	Med	Powder delivered on demand at the requested rate.	TRL 6	May 2019
Integral AM CAM system	Low	Computation of AM CAM plan from within the AM controller.	TRL 6	August 2019
Powder Delivery Subsystem	Med	Powder and shield gas delivery to the work position at appropriate linear velocities.	TRL 4	October 2020
AM Controller Subsystem	Med	Control over all external equipment: CW laser, pulse laser, powder feeders, galvo, gas settings, and sensors	TRL 6	October 2020
CNC AM control macros	Low	Ability to express AM intent from within G-code.	TRL 4	February 2020
Repair Application software	Med	Successful demo repair	TRL 4	August 2020

HOW

Projected Business Model:

PINE is considering multiple paths to commercialize our product. Since we designed our repair system in a modular fashion there are multiple options for deployment.

We can sell the system as an entire unit.

We can sell the system to 3rd parties as modules for their custom integration.

We have used our proven additive controller on several internal projects as it provides a fast, flexible avenue for adding AM and/or laser processing abilities to our CNC machines or robots.

Company Objectives:

Depending on the route finally taken to commercialization, PINE has begun discussing spinning off a new manufacturing venture and licensing the technology to Prime vendors.

Potential Commercial Applications: In addition to the aircraft part repair application, the repair system would be applicable to heavy machinery and tooling repair. The submodules of the repair system have more market potential, such as DED production or laser cutting applications.

Contact: Todd Sparks, Principal Investigator
toddesparks@mopine.com (573)612-1352

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-871

Topic # N181-028

Precision Machining of Composite Structures

Product Innovation and Engineering L.L.C.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 261, CH-53 Heavy Lift Helicopters

Transition Target: PMA-261, PMA-262

TPOC:
(301)342-9369

Other transition opportunities:

Primes – GKN Aerospace, Boeing, Spirit Aerosystems, Albany, Aurora

Notes: The illustration shows detail of a laser drilled hole demonstrating the feasibility of machining FRP material systems with a high power CW laser, a pulsed green laser, and a pulsed near-IR laser. This brings laser cutting capability to the growing use of FRP material by the Navy and throughout the military.

Drilling / Machining Fiber Reinforced Polymers (FRP)

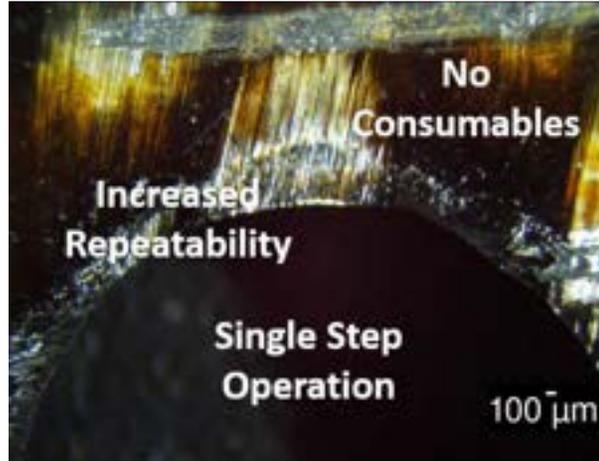


Photo courtesy of Product Innovation and Engineering This picture shows the back side of a hole drilled with pulsed laser with un-optimized processing parameters.

WHAT

Operational Need and Improvement:

- Reducing aircraft weight drives requirement to replace metallic components w/ FRP
- Reduce cost of machining Fiber Reinforced Polymer (FRP) materials
- Develop laser cutting system for FRP material, focus on glass and carbon
- Non-contact cutting reduces cost of replacing current tooling which is worn out machining FRP materials.

Specifications Required:

- Precision fastener hole and countersink machining process without inducing damage actual part
- Precision within the specified hole diameter +0.006" max,
- Surface roughness height rating of 250 or less w/ no breakout piles on exit side
- No delamination 0.010" deep from edge of hole or into the part from hole
- No splintering allowed beyond 0.010 in deep at entrance/exit of hole
- No damage to composite material from applied or induced heat
- Temperature limit should not exceed 50° F below the glass transition temperature

Technology Developed:

PINE is developing a laser cutting system for Fiber Reinforced Polymer material

Warfighter Value:

- Reduce operating cost by reducing frequency of expensive abrasion resistant drill bit
- Improve laser edge and shape cutting with single set-up in one process
- Reduce manufacturing time by eliminating need for guide hole
- Improves manufacturing process by utilizing dual lasers, rough cut with high power laser, finish cut with pulsed laser

WHEN

Contract Number: N68335-20-C-0128 **Ending on:** November 20, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete Phase I	Low	Develop innovative approach for a precision machining tool	TRL 4	September 2019
Initial Phase II Base (Yr 1)	Low	Develop prototype machine	TRL 4	November 2020
Initial Phase II Base (Yr 2)	Med	Develop necessary processing parameters and demonstration of precision fastener hole drilling capability on target material	TRL 5	June 2022
Initial Phase II Option (Yr 1)	Med	Refine processing parameters for target material and investigate new material systems.	TRL 6	November 2022

HOW

Projected Business Model: PINE is pursuing two paths:

1. Develop in-house machining capabilities, eliminating need to transition knowledge base
2. License technology to primes, allowing them to integrate this capability into their current workflow

Company Objectives:

Currently we are exploring both options and have not made a decision

Potential Commercial Applications:

Benchmark the precision machining system to machine and countersink fastener holes in composite structures for aircraft components. Transition the technology to provide an efficient and effective tool to produce countersunk fastener holes in carbon and glass fiber laminate composite materials used for military air platforms, as well as civilian air vehicle components and other industrial applications.

Contact: Aaron Flood, Principal Investigator
aflood@mopine.com (620)210-0357

Company	Topic	Project Title
Design Mill, Inc.	N172-101	Shipboard Dimensional Analysis Tool (SDAT)
Freedom Photonics LLC	N182-108	Photonic Integrated Circuit Reliability Prediction, Verification and Validation

Department of the Navy SBIR/STTR Transition Program

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MCSC-PRR-3624

Topic # N172-101

Shipboard Dimensional Analysis Tool (SDAT)

Design Mill, Inc.

WHO

SYSCOM: MARCOR

Sponsoring Program: MCSC, DC Systems Engineering Acquisition and Logistics (SEAL)

Transition Target: PEO Land Systems

TPOC:

sbir.admin@usmc.mil

Other transition opportunities:

Organizations with transportability analysis needs to include PFM LCES, Marine Corps Ground Vehicle Acquisition Program Management Offices, NAVSEA (PEO Ships), Industrial Warehousing, Military Sealift Command, TRANSCOM, Navy Amphibious and Prepositioning Ships Program Management Offices, Shipping Industry, and the Space Optimization Industry. The goal is to provide a valid 3D virtual means of transportability analysis to vehicle or ship programs contemplating a design or design modification.

Notes: The above image from the current development version of SDAT illustrates points of impact between a Humvee and a bulkhead in a vehicle storage area aboard LPD-17. (2) Design Mill anticipates connecting with commercial companies that need a capability similar to SDAT to support vehicle or facility design and modifications. (3) Design Mill also plans to enhance SDAT further with a hardware offering that has continuous scanning capability that capture a ship, facility or warehouse in real-time to automatically generate inputs for SDAT and ultimately track facility modifications and/or stored assets.



Design Mill Image of SDAT Analysis Capability

WHAT

Operational Need and Improvement: Marine Corps Ground Vehicle Acquisition PMOs and Navy Amphibious and Prepositioning Ships PMOs do not have a precise way of determining shipboard vehicle transportability constraints early enough in the design process. Current methods of assessing transportability involve vehicle prototyping, and taking internal measurements of ships in various locations to include angles at the tops and bases of ramps to ensure clearance and identifying obstacles to include pipes, wire bundles, lighting, and other types of fixtures. A three-dimensional virtual means of conducting valid shipboard transportability assessments for vehicles and vehicle modifications as early as possible in the acquisitions process will reduce cost and schedule associated with the design of vehicles suitable for deployment aboard amphibious and preposition ships.

Specifications Required: The Shipboard Dimensional Analysis Tool (SDAT) is a 3D virtual capability that allows an engineer or analyst to pull up the desired 3D ship data (typically a ship point cloud derived from a LIDAR scan), select or upload 3D vehicle data (typically a vehicle CAD model), specify desired vehicle-to-ship clearance distance, select a path through the ship, conduct 3D physical interference analysis, and generate reports and products to support vehicle design decisions. The tool's user interface must be intuitive. It must allow for a fine level of detail, calculating for collisions at increments of one inch (objective) or every foot (threshold) along a selected path. The threshold and objective times to complete collision computations for a 300-foot path with a one-inch distance interval are five minutes and one minute, respectively. Finally, it must provide valid and verifiable results.

Technology Developed: The Shipboard Dimensional Analysis Tool (SDAT) integrates hardware, software and cloud solutions enabling virtual transportability assessments for vehicle designs. It integrates 3D ship and vehicle data with game engine and machine learning technology and uses novel methods of rendering surfaces and computer processing to enable path selection, collision computation and analysis in 3D virtual environments. Each element of SDAT has been successfully demonstrated and integration is underway.

Warfighter Value: SDAT's 3D virtual and augmented reality capability will reduce cost and schedule requirements associated with the design of vehicles suitable for deployment aboard amphibious and Maritime Preposition Ships by removing the requirement for prototyping for transportability analysis.

WHEN

Contract Number: M67854-19-C-6506 **Ending on:** September 26, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial Functional Prototype of Capability 2.9.1	Low	Integration of Visualization, Voxels, Navigation and Collision Modules	6	4th QTR FY20
Graphical User Interface(GUI) Prototype Complete 2.1.2	Low	Demonstrate Functionality of User Interface	7	1st QTR FY21
Collision Detection Module Integrated 2.3	Low	Successful Demonstration of Collision Calculations within the prescribed time limit with error minimized	7	1st QTR FY22
AI Navigation Module Integrated 2.2	Low	Successful Demonstration of AI path Generation based on user input	8	1st QTR FY22
SDAT Prototype Complete 2.9 (Full Demonstration)	Low	Successful Demonstration of all project objective to sponsor and key stakeholders	8	3rd QTR FY22
Commercial Software Available	Low	Product available for sale	9	4th QTR FY22

HOW

Projected Business Model: Design Mill plans to build the SDAT business model around software licensing as a standalone product and to other software vendors that would need to incorporate dimensional analysis in their offering as a software plug-in. Our software will be cloud based with tiered pricing based on number of users, amount of data, number of assets, and storage size. We anticipate a set-up fee per customer that includes hardware and software installation, testing, and shipment of hardware. We anticipate customization of the software based on end user use cases (ships versus warehouses); on-going maintenance will keep SDAT infrastructure current with modern cloud offerings.

Company Objectives: Design Mill is a strategic systems integrator delivering pioneering solutions for the Department of Defense and industry-leading organizations. A three-time recipient of the Intel Software Innovator of the Year award, Design Mill continually works to transform the integration of cutting-edge interactive hardware and software through innovative design, development, and processes. We have a long history of commercializing software products, SDAT is one of those technologies we are bringing to market. We are interested in talking with Prime Contractors (Shipbuilding and others), any logistic related programs, as well as Program offices that would like to analyze their capabilities throughout a mission.

Potential Commercial Applications: Design Mill Inc is planning to commercialize SDAT where laser scanning and 3D models are used for analysis. The end use cases we anticipate solving first are industrial warehousing and ship loading but can be expanded to numerous applications where space planning/utilization is a critical process. Ships and vehicles are the initial focus but warehouse equipment and assets will be second. Industries we are targeting include logistics, aviation logistics, rail, factory planning, port operations, and law enforcement (forensics). Follow-on applications will come with hardware development and installation that enhance SDAT's capability with continuous laser scanning. We also are planning a technology roadmap that integrate software enhancements for artificial intelligence, improved AI navigation and feedback from actual loading sequences to deliver additional capabilities and revenue streams.

Contact: Nathan Greiner, President
nathan_greiner@designmillinc.com

563.587.8778

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-851

Topic # N182-108

Photonic Integrated Circuit Reliability

Freedom Photonics LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: NAE Chief Technology Office

Transition Target: TBD

TPOC:
(301)342-4122

Other transition opportunities:

Ultimately, these test methods and models will be marketed to PIC device manufacturers, prime contractors, and system users, including the US Department of Defense.

Notes: (Image Left) Photonic integrated circuits (PICs) offer the potential increase system capability and reduce SWaP-C by replacing multiple discrete and bulky photonic modules with a single component.

(Image Right) Scanning electron microscope image of a failed photonic integrated circuit. This Phase II effort seeks to improve understanding of how and why photonic integrated circuit components fail and to develop tools for predicting reliability in various deployed environments.



Image Courtesy of Freedom Photonics, LLC

WHAT

Operational Need and Improvement: Photonic Integrated Circuit (PIC) and Planar Lightguide Circuit (PLC) based devices are rapidly gaining importance as core components in communications, sensing, computing and medical diagnostic systems for military and commercial applications. Thus, it has become very important to develop methodologies for PIC/PLC reliability prediction, verification, and validation. Freedom Photonics and The Aerospace Corporation have formed a strong team to bridge this information gap, primarily as it relates to PICs/PLCs for aerospace applications.

Specifications Required: Representative PICs should be selected and the main degradation modes should be experimentally and theoretically evaluated. Acceleration factors temperature, electrical bias, optical power, radiation, and mechanical stress should be considered according to MIL-HDBK 217 and MIL-STD-810. Particular emphasis should be placed on understanding the influence of individual PIC/PLC devices on the reliability of their neighboring devices on the same chip.

Technology Developed: The goal is to develop and demonstrate suitable test methods for PIC/PLC reliability analysis and corresponding reliability prediction software tools that can be used for aerospace applications and potentially in other military and commercial areas such as fiber optic networks, data centers and infrared sensors. The test methods and software tools will be verified and validated through the Phase II period of performance by selecting appropriate PIC/PLC devices for experimental reliability testing. These PIC devices will be subject to environmental, mechanical, and accelerated aging stress tests followed by root cause analysis of device failure.

Warfighter Value: Advanced systems based on optical technology have become ubiquitous to the modern warfighter. Photonic integrated circuit (PIC) and devices are rapidly gaining importance as core components in these systems due to their performance and compactness. In many cases, multiple discrete and bulky photonic modules can be replaced with a single PIC component. The incorporation of these devices into Department of Defense platforms is being hindered by the lack of information on their reliability. This Phase II effort seeks to improve understanding of how and why photonic integrated circuit components fail and to develop tools for predicting reliability in various deployed environments. This will ultimately enable more widespread adoption, resulting in smaller, lighter, cheaper, and more capable optical systems for the warfighter.

WHEN

Contract Number: N68335-20-C-0059 **Ending on:** December 5, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
1550 nm DFB/SOA PIC Lifestest Completed and Modelled	Low	Completed qualification of 1550 nm DFB/SOA PIC devices ready for commercial deployment with predictable reliability model	5	August 2021
Initial PIC Predictive Reliability Simulation Software Completed	Med	Software tool which provides modelling of PIC device reliability subject to use conditions and design type demonstrated	4	July 2022
Update PIC Predictive Reliability Software to Include Silicon Photonic Devices	Med	Completed testing of silicon photonic PIC devices with predictable reliability model	3	December 2022

HOW

Projected Business Model: The business model for the reliability prediction software technology is to market these test methods and models to PIC device manufacturers, prime contractors, and system users, including the US Department of Defense.

Company Objectives: We anticipate that the Navy SBIR/STTR Transition Program (STP) Forum will facilitate the development of a Technology Transition plan to define a clear path to the transition this technology into prime contractors, and system users, including the US Department of Defense.

Potential Commercial Applications: We anticipate these reliability prediction tools to be applied not only to PICs within the US Department of Defense, but to PICs which are commercially used for civilian applications, such as fiber optic networks, data centers, and telecommunications.

Contact: Dr. Paul Leisher, Vice President of Research
pleisher@freedomphotonics.com 805-967-4900 x7050

Featured Technologies

- Air Platforms
- Energy and Power Technologies
- Ground and Sea Platforms
- Human Systems
- Sensors
- Space
- Weapons Technologies

Air Platforms (Navy FST Booth: 3 August)



Company	Topic	Project Title
Corrdesa	N112-154	Selective Electroplating Technology Improvement (SETI)
Corrdesa	N162-129	Optimized Galvanic Corrosion Control of Repair Bushings and Fasteners Utilizing Advanced Performance Organic Coatings
Mainstream Engineering Corporation	N181-005	Improving Lifetime of Generators on Legacy Aircraft
NexTech Materials, Ltd. dba Nexceris, LLC	N181-013	Compact, Lightweight, Power-Dense Integrated Fuel Cell System
Platform Aerospace	AF171-124	Ultra-Endurance UAV
Precision Combustion, Inc.	N182-118	System for Onboard Engine and Bleed Air Monitoring and Filtering

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NAVAIR 2020-969

Topic # N112-154

Selective Electroplating Technology Improvement (SETI)

Corrdesa

WHO

SYSCOM: NAVAIR

Sponsoring Program: COMFRC

Transition Target: Fleet Readiness Centers

TPOC:
(904)790-6380

Other transition opportunities:
AFLCMC, USAF C-5, C-130, F-35



U.S. Navy photo/Released, <https://www.navair.navy.mil/media/4956>

Notes: P-8 flight line selective-anodize repair of damaged static port, still corrosion free after 2 years in the field.

First Article, ruggedized version produced for Lockheed Martin for ZnNi repair.

WHAT

Operational Need and Improvement:

The US Navy operates in very hostile, corrosive locations, placing substantial environmental stress on weapons systems, demanding high performance materials and coatings for their protection. Such protective coatings degrade and become damaged. There is a need for a plating/anodizing system that can be used to repair coatings, in-situ at both the Fleet Readiness Centers (FRCs) and Detachment Sites.

Specifications Required:

A mobile, selective plating/anodizing system that can be used, locally on the flight line. It must be non-drip, to avoid contamination of adjacent components and electronics and reduce hazardous emissions to the operator. Repairs must be executable within a one hour time frame.

Technology Developed:

A portable, non-drip selective plating/anodizing system for repair of protective metal coatings directly on the aircraft or in the workshop. The scalable, closed-loop electrolyte flow technology avoids unwanted drips & runs onto components adjacent to the plating area and significantly reduces the risk of hazardous material exposures to the artisans. By enabling repair work on the flight line this system significantly reduces turn time for the repair, thereby improving platform readiness by protecting aircraft structures from corrosion.

Warfighter Value:

Bringing non-drip plating and anodizing directly to the aircraft will save time by avoiding disassembly of components and shipping to off-site, plating shop facilities.

WHEN

Contract Number: N68335-16-C-0449 **Ending on:** January 23, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
First prototype non-drip anodizing/plating system	Low	Delivered	6	April 2017
Corrosion tests of anodized coupons (ASTM B117)	Low	Pass - establishing approved process	6	October 2017
P-8 flight line repair demonstration on static port	Low	No dripping, <30 minutes repair time	7	July 2018
Second prototype non-drip anodizing/plating system	Low	Addresses GAP analysis	7	September 2019
Anodizing demonstration with larger custom tooling - on static port surrogate	Med	Reduced process time, no dripping	7	August 2020
P-8 follow-up demonstration with larger custom tooling	Med	Reduced process time, no dripping	8	October 2020

HOW

Projected Business Model:

Corrdesa has an established manufacturing partner with the capability to produce the number of systems required by the FRCs.

Corrdesa intends to patent the scaled-up tooling design and license for use in related manufacturing processes.

Company Objectives:

At the FST event we want to make contact with other defense sustainment organizations that could benefit from localized, non-drip metallic coatings repair (anodize, plating), in NAVSEA for example.

Corrdesa will further develop this technology for in-situ, larger scale coatings applications for both OEM operations and sustainment, for example, treatment of friction stir-welds and heat affected zones from welding.

Corrdesa have developed a custom, ruggedized unit for Lockheed Martin F-35 program to repair damaged, legacy cadmium coatings with zinc-nickel. This configuration will be sold worldwide.

Potential Commercial Applications:

The non-drip plating/anodizing system can also be used in commercial MRO (Maintenance Repair Overhaul). Corrdesa have already demonstrated the system to Delta Airlines (Atlanta) and will develop this opportunity.

Contact: Alan Rose, CEO - Principal Engineer
arose@corrdesa.com 770 683 3960

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-984

Topic # N162-129

Optimized Galvanic Corrosion Control of Repair Bushings and Fasteners Utilizing Advanced Performance Organic Coatings

Corrdesa

WHO

SYSCOM: NAVAIR

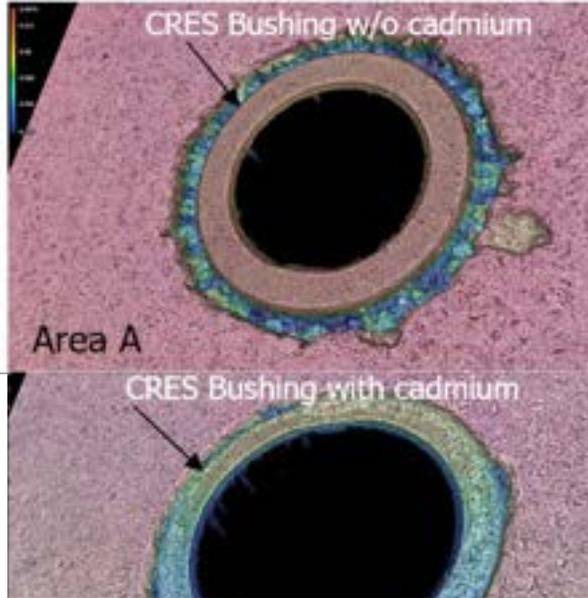
Sponsoring Program: Fleet Readiness Centers

Transition Target: Applicable to all Type/Model/Series of Aircraft (T/M/S A/C)

TPOC:
(904)542-4516

Other transition opportunities:

US Army helicopters
US Air Force T/M/S A/C



Place holder could replace with own corrosion photo

WHAT

Operational Need and Improvement:

NAVAIR wishes to eliminate the use of toxic cadmium on bushings used in repair. The proposal is to leverage NAVAIR reactive pigment coating technology however, the current development of these paint primer systems is inhibited by a lack of understanding on how the system behaves and protects coated aircraft components.

Develop innovative computational models and analysis tools that can support and accelerate the maturation of the reactive pigment coatings, to predict their interaction with metallic and non-metallic surfaces and quantify their performance in the laboratory and in naval operating environments.

Specifications Required:

Given the capability to customize the manufacturing process of metal filled primers, a model-based analysis/optimization tool is required that can adjust numerous parameters in order to optimize coating system performance. An accurate electrochemical modeling capability that explicitly accounts for the chemistry and structure of metal-filled primers. This would make it possible to predict the behavior of the primer in a primer/topcoat system as a function of resin system chemistry, solvents, additives, metal particle alloy, particle size and shape, surface chemistry, and loading.

Technology Developed:

Leveraging our unique simulation capability, Corrdesa will develop an easily applied Reactive Pigmented Coating (RPC) formulation specifically optimized to control galvanic corrosion of installed bushing repairs of aerospace structural materials as an alternative to toxic cadmium electroplating.

Warfighter Value:

Reduce labor hours
Reduce turn-around time (TAT)
Improve Operational Readiness
Eliminate environmental hazard of cadmium

WHEN

Contract Number: N68335-19-C-0524

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Electrochemical data acquisition from existing RPC formulations	Low	Valid boundary conditions for electrochemical modeling	7	August 2020
Optimization and ranking of best performing RPC formulations	Low	Downselection of top performing RPC systems	7	March 2021
Corrosion exposure test & post analysis of optimized RPC formulations	Med	Correlation between physical finding and model prediction	7	June 2021
Modeling and Aircraft Dem/Val using best performing RPC	Med	comparable performance to current standard	8	August 2021
Process Specification & Instructions	Low	finalized process specs & instructions	9	January 2022

HOW

Projected Business Model:

Corrdesa will license the optimized formulation to NCP Coatings and AV-Dec for manufacturing, commercialization and application initially on F/A-18, T-6, T-44, T-45, and F/A-18. Corrdesa will continue to provide support and further developments to the technology.

Company Objectives:

Connecting with other agency maintenance facilities as well as OEMs that can implement the technology into new platforms.

Potential Commercial Applications:

The coating can be implemented into many other fixture systems in platforms built by Lockheed, Boeing and Bell.

Contact: Alan Rose, CEO - Principal Engineer
arose@corrdesa.com 770 683 3960

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-882

Topic # N181-005

High Power Density Aircraft Power Factor Correction
Mainstream Engineering Corporation

WHO

SYSCOM: NAVAIR

Sponsoring Program: Multiple PMAs

Transition Target: Legacy Naval Aircraft

TPOC:
(301)342-0365

Other transition opportunities: Other Military and Commercial Aircraft; Shipboard Long-Range Discrimination Radar (LRDR) systems

Notes: Mainstream Engineering plans to implement their lightweight power factor correction (PFC) unit into legacy aircraft systems to increase aircraft readiness, improve generator life and reliability, and reduce life-cycle costs.



Courtesy of the Navy:

<https://www.dla.mil/News/Images/igphoto/2002097951/>

WHAT

Operational Need and Improvement: NAVAIR desires to develop lightweight and compact equipment to improve the leading power factor in aircraft power distribution systems. The goal is to improve the lifetime and reliability of generators on legacy aircraft systems. NAVAIR is interested in solutions that will improve the leading power factor to a lagging power factor or unity. The power factor correction (PFC) unit must be compact and optimized for Size, Weight, Power, and Cost (SWaP-C) to have minimal effect on currently existing legacy aircraft systems. Additionally, the PFC unit must also be able to sustain high temperatures, shock, vibration, and produce minimal electromagnetic interference (EMI). Mainstream's low SWaP-C solution will improve generator service life and reliability – resulting in significant increases in aircraft readiness and reduced life-cycle costs.

Specifications Required: The PFC system is rated to correct 115VAC, 400 Hz, three phase 0.98 leading to 0.98 lagging power factor loads to an ideal power factor range of 0.75 lagging to unity. Comply with Military Standards 461 (EMI), 704 (Aircraft Electrical Power), and 810 (810 is modified for shock and vibration by MDC3376 spec). The PFC must be capable of operations at 71 degrees C ambient temperatures using an integrated Thermal Management System (TMS) and weigh less than 20 lbs.

Technology Developed: Technology Developed: Mainstream Engineering has developed a high-power-density PFC unit that is designed to calculate the power seen by the generator and adjust its inductance to keep the load power factor between 0.75 lagging and unity at all times. The PFC uses a low complexity, high reliability, low EMI design which is also designed for maintainability.

Warfighter Value: Integration of Mainstream's PFC system increases generator reliability and service life, reduces logistic costs, maintenance actions/costs, and life-cycle costs. Increased generator reliability, service life and reduction in maintenance actions will result in significant increases in aircraft availability and readiness.

WHEN

Contract Number: N68335-19-C-0328 **Ending on:** August 30, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase II Base: Revise, Design, and down-select material for Inductor	N/A	Measured power loss of material options	TRL 3	June 2020
Phase II Base: NAVAIR Test Bench Second-Generation PFC Design	Med	Successfully demonstrate thermal and electrical performance with generator at NAVAIR facility	TRL 5	December 2020
Phase II Base: Build and test pre-production hardware	Med	Achieve thermal and electrical performance, power density, and efficiency goals	TRL 6	July 2021
Phase II Option: Produce and Test production level hardware	High	Full power operation on Naval Aircraft	TRL 6/7	August 2022

HOW

Projected Business Model: Mainstream Engineering will manufacture the PFC units for low-volume custom orders with a timeline of 12-16 weeks. The PFC unit will be sold as a comprehensive stand-alone unit for integration within prime contractor's systems/subsystems. With high volume orders, Mainstream plans to outsource the custom inductors to a magnetic manufacturer while fabricating the rest of the components in-house to avoid long lead times.

Company Objectives: Mainstream Engineering intends to establish transition/commercialization partnerships with prime contractors such as Boeing, Lockheed Martin, and Northrop Grumman for the PFC system. Mainstream's secondary objective is to investigate a capacitive based PFC system.

Potential Commercial Applications: Commercial applications for the PFC system include industrial generators and large inductive / capacitive loads where intelligent power factor correction is beneficial. Mainstream's PFC system is an alternative to capacitor-based PFC used on individual loads found in industrial / commercial facilities. Our system can handle single or multiple loads and maintain the power factor within a desired range.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-835

Topic # N181-013

Compact, Lightweight, Power-Dense, Integrated Fuel Cell System
NexTech Materials, Ltd. dba Nexceris, LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-263

Transition Target: Group II and Group III Unmanned Aerial Systems (e.g., the Stalker)

TPOC:

Other transition opportunities: Other military applications of SOFC based power systems include:

- Propulsion and auxiliary power on unmanned ground vehicles
- Auxiliary power units for tanks and military ground vehicles
- Portable power for exoskeletons and battery charging
- Transportable power for forward operating bases



Copyright 2020, Nexceris LLC

WHAT

Operational Need and Improvement: Solid oxide fuel cells provide a path to meet the following operational needs.

- Longer mission durations, larger payloads, and operation on military logistic fuels are needed for unmanned aerial systems.
- Silent, efficient, and robust power sources that operate on JP-8 fuel are needed for military ground vehicles.
- Small, lightweight, and efficient power sources are required for exoskeletons and battery chargers.

Specifications Required: The solid oxide fuel cell power system being developed for NAVAIR will meet the following specifications:

- Power level (nominal): 500 watts
- Electrical efficiency (JP-8 fuel): 30 percent
- Gravimetric power density: 65 to 120 W/kg
- Scalability: up to 10 kW
- Form factor: Tailored to specific platforms.

Technology Developed: A leading innovator in SOFC technology, Nexceris is developing logistic fueled power systems for range of high value military applications. Attributes of the technology include:

- Lightweight systems are enabled by an ultra-high power density SOFC stack design.
- SOFC cell and stack materials and operational modes enabling very high efficiency
- Custom stack and system design to application specific requirements
- Unprecedented tolerance to sulfur impurities in JP-8 fuels (up to 100 ppm after fuel reformation)

Warfighter Value: SOFC power systems based on Nexceris' technology offer the following benefits to the warfighter.

- Broader range of CONOPS for unmanned aerial systems
- New power generation capabilities that do not require modifications to existing logistic fuel infrastructure
- Ease of getting more power deeper into the field

WHEN

Contract Number: N68335-19-C-0603 **Ending on:** February 26, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Construction of testing apparatus complete	Low	Fabrication of testing apparatus complete	3	July 2020
Approach selected for system pre-heating	Low	Method for starting up in ≤30 minutes identified	3	July 2020
Target SOFC performance (stack/CPOX integration)	Med	Achieve ≥500 watts total stack power	4	September 2020
Target SOFC performance (stack/HX integration)	Med	Achieve ≥500 watts total stack power	4	November 2020
Target SOFC performance (full system integration)	High	Achieve 550 watts total stack power at 43 percent stack efficiency	5/6	February 2021
Target Performance in prototype system demonstrated at NAVAIR	Med	Achieve 550 watts total stack power at 43 percent stack efficiency	5/6	July 2021

HOW

Projected Business Model: Nexceris business model is to commercialize technology through product development and manufacturing.

- Nexceris plans to manufacture SOFC stacks and systems and establish partnerships with Military Primes for integration of the system into UAS platforms. Nexceris then will apply the technology to develop products for other military applications.
- We have considerable experience in producing SOFC materials, cell manufacturing, stack design and modeling, fabrication and testing of SOFC stacks, and integration of stacks into fuel cell systems.
- Because we are vertically integrated, we tailor our SOFC technology to meet application-specific requirements.
- Our current focus is the design and development of highly efficient and power dense SOFC stacks and systems. As a vertically integrated SOFC developer, Nexceris' commercial objective would be to manufacture the cells, stacks, and systems for the UAS and other military applications.

Company Objectives: Nexceris is an established player for 25 years and a pioneer in the alternative energy space, Nexceris is ISO 9001-2015 certified.

- Nexceris focuses our materials science expertise on creating innovative products that improve the quality, efficiency and safety of energy and environmental systems. Our vision is to create a better world through energy innovations.
- Nexceris SOFC strategy is to first develop technology and products for the military, and then to scale-up SOFC stack manufacturing and adapt the technology for commercial applications.

Potential Commercial Applications: There is a wide range of commercial applications where this technology can be applied:

- Residential (micro) combined heat and power (mCHP) systems
- Large scale commercial CHP systems
- Remote site power
- Electric vehicle range extenders

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ONR Approval #43-7504-20

Topic # AF171-124

Ultra-Endurance UAV

Platform Aerospace

WHO

SYSCOM: ONR

Sponsoring Program: Low Cost UAV Swarming Technology (LOCUST)

Transition Target: Airborne Intelligence, Surveillance, Reconnaissance (ISR)

TPOC:

Mr. Lee Mastroianni
lee.mastroianni@navy.mil

Other transition opportunities: Other defense use cases include maritime patrol, anti-submarine warfare, early-warning signals intelligence (SIGINT), secure communications relay, and command & control over other assets with lesser endurance. Potential customers outside the U.S. Navy include the U.S. Army, Department of Homeland Security, and NASA.

Notes: Vanilla Unmanned Aerial System (UAS) holds the world record* for long-endurance flight with heavy fuel and is capable of carrying and powering multi-intelligence (multi-INT) payloads for up to 10 days. Vanilla's modular payload design enables rapid swap-out of payloads and the ability to operate multiple sensors on a single flight (multiple payload bays). The aircraft is Satellite Communications (SATCOM) enabled for beyond visual line of sight (BVLOS) operations globally, with the ability to transmit sensor data in real-time. To support forward operations, Vanilla is truck-launched (see photograph) and does not require an established runway. Vanilla UAS has the endurance and flexibility to support a wide spectrum of missions over land, sea, and ice. Operational readiness was proven during a simulated deployment in 2020, requiring 30 days of continuous flight operations and active ISR sensor payloads.

*Unofficial record; October 2017 121hr continuous flight was not observed by an independent review body



Image courtesy of Platform Systems, Inc., 2019

WHAT

Operational Need and Improvement: Military commanders and the intelligence community require persistent overhead surveillance at an attritable cost point. Persistent multi-intelligence coverage of 'gray zone' regions (e.g., South China Sea) and geographic choke-points is necessary to deter armed conflict and inform warfighter decisions. An improved endurance technology would mean more of ISR budgets result in "on target" coverage with less sunk costs in aircraft transit time. Additional defense requirements include targeting, swarm vehicles command & control, and trusted communications relay.

Specifications Required: Line of Sight (LOS) and BVLOS UAS operations in support of ground or surface missions and Tactical Operations Centers (TOC). Airborne ISR, command & control, and/or communications relay support requiring continuous or near-continuous coverage of a target area. Single UAS endurance over 5 days and up to 10 days, with payloads ranging from 20 to 100+ pounds and the capacity to carry multi-intelligence sensors on a single flight. Fully autonomous launch, recovery, and flight. 30% reduction of on-site manning and logistics compared to existing UAS systems.

Technology Developed: Vanilla is a fixed-wing Group III UAS capable of greater than 7 days of continuous flight with an operational payload and a 15,000NM operational range. Vanilla also serves as a heavy-lift unmanned vehicle relative to other Group III aircrafts on shorter duration flights. Vanilla's minimalist sailplane design greatly reduces and simplifies Operations and Maintenance (O&M) costs, and the modular airframe can accommodate various multi-intelligence sensors and communication payloads. A ruggedized launch system enables deployment from poor surface conditions and high crosswinds. Launch, flight, and recovery are all autonomous.

Warfighter Value: The Vanilla UAS presents a step change in Group III UAS endurance and design, with corresponding O&M cost reductions. At a Maximum Gross Takeoff Weight (MGTO) of 620 lbs., Vanilla can carry 100+ lbs of payload, fly in excess of 7 days, and climb to altitudes up to 15000ft. 10 day endurance can be reached with lighter payloads, representing a 15,000NM operational range. Vanilla's sailplane design and modular payload enables unbroken ISR operations with the ability to carry various multi-INT sensors on a single flight. Payloads can be rapidly swapped and include: full motion video, RADAR, wide area motion imagery, signals intelligence (SIGINT), magnetic anomaly detection, and secure communications.

WHEN

Contract Number: N68335-19-C-0257 **Ending on:** July 5, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
121 hour (>5d) world-record flight	N/A	World-record flight duration (unofficial)	5	1st QTR FY18
First operational payload	N/A	Integrate and fly TASE400 EO/IR payload	6	3rd QTR FY18
Truck-based launch	N/A	Prove launch system for high crosswinds and poor surface conditions	6	1st QTR FY20
Autonomous launch & recovery in austere environment	N/A	High-altitude desert launch and recovery with fully autonomous system	6	2nd QTR FY20
30-day Demonstration	High	30 days of continuous flight operations	7	1st QTR FY21
Weather hardening	High	Successful arctic multi-day flights	7	3rd QTR FY21

HOW

Projected Business Model: Vanilla UAS is designed and manufactured by Platform Aerospace. It is currently in low-rate production and will transition to full-rate production in 2021. Platform intends to scale production and its operational capacity in order to service multiple contractor-owned, contractor-operated defense and commercial operations. Platform continues to evaluate alternative business models, to include government-owned, government-operated and commercial leasing arrangements.

Company Objectives: Platform's goal is to deliver a true multi-sensor, multi-mission, ultra-long endurance UAS that can provide persistent data and quickly convert in response to rapidly changing conditions. Platform continues to mature the Vanilla technology in response to lessons-learned from endurance flight operations, customer feedback, and a list of key development targets to further endurance and ruggedness. Vanilla development and production is progressing along a block roadmap that phases in performance and manufacturability improvements, modular swap capabilities, and a vertical lift variant. By focusing on the vehicle endurance and modular flexibility, Platform will meet the needs of a wide variety of government and commercial organizations.

Potential Commercial Applications: Vanilla UAS is designed for maximum flexibility and endurance with 100+ lbs. payload capacity, making it ideal for various commercial and defense applications. Potential commercial applications are most promising in markets where data collection needs require long distance or wide area flight coverage, such as geospatial surveying and infrastructure inspections (e.g. oil & gas, electric transmission). Vanilla can carry lidar and multispectral sensors in place of standard electro-optic and infrared (EO/IR) gimbals and has the physical space and power capacity to perform on-board processing. Vanilla would also be useful in natural resource monitoring, command & control in disaster situations (e.g., forest fires, post-hurricane damage survey), and immediate post-disaster communications relay provisioning.

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NAVAIR 2020-828

Topic # N182-118

System for Onboard Engine and Bleed Air Monitoring and Filtering
Precision Combustion, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: TBD

Transition Target: (i) An improved breathing air filtration system for Personal Protection Equipment (PPE); and (ii) catalytic scrubber in the hot zone of the engine bleed air prior to the heat exchanger to destroy and filtrate contaminants resulting in clean air to OBOGS

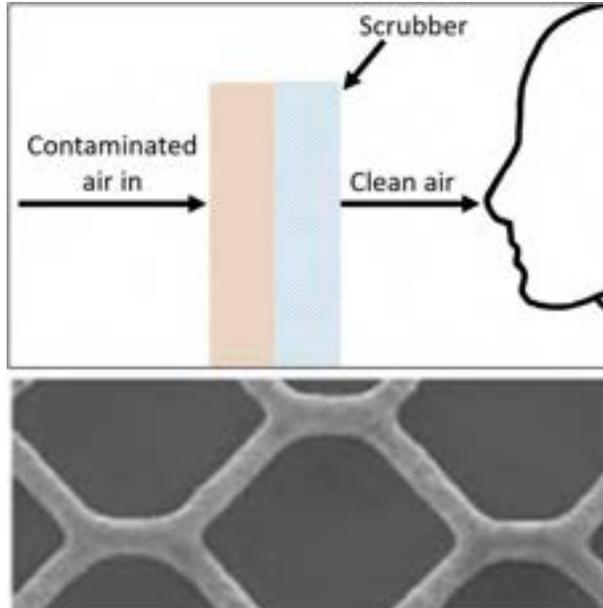
TPOC:

(301)342-3728

Other transition opportunities:

Given this is a platform technology, other breathing air filtration applications are envisioned, both for personal protection, as well as for general indoor air filtration.

Notes: Re-VID (TM) : Reusable Virus Impairment Device platform technology approach



Images Courtesy of Precision Combustion, Inc.

WHAT

Operational Need and Improvement: This catalytic scrubber technology promotes destruction/inerting of contaminants in air and provides improved prevention of respiratory contamination. The risk of respiratory infection without respirator use is 63%. Surgical and cotton masks seem to be ineffective in preventing the dissemination of SARS-CoV-2 from aerosol transport from patients with COVID-19 to the environment and external mask surface. With N95 filtering facepiece respiratory infection risk is 9.5%. Using OBOGS Pre-filter Technology as a mask's coronavirus filter should reduce infection risk to 0.1%. OBOGS Pre-filter Technology uses a Microlith®-based catalytic scrubber for real-time filter and destruction of organics, organophosphates, Volatile Organic Compounds (VOCs), and other bleed air contaminants from the pilot air supply line in addition to killing viruses when this Microlith®-based catalytic scrubber is used in masks.

Specifications Required: Respiratory infection rate of 0.1% against enveloped and non-enveloped viruses whose virus particle size range between ~10 nm and 6 µm.

Technology Developed: High surface area nanofiber catalytic scrubber and destructive filter. The final report will show characteristic data on virus and Microlith®-based catalytic scrubber filtration system interaction.

Warfighter Value: A mask using this technology will:

- Provide outward and inward protective effectiveness
- Seal completely, without any bypass of particles, ensuring the actual efficiency of the mask is achieved
- Be available in N-95 / N-99 / P-100 NIOSH ratings
- Be comfortable to wear in humidity
- Be one Size Fits All
- Destroys pathogens
- Be able to talk without distortion
- Filter will be able to be regenerated
- Comfortable to wear (e.g. eliminate fogging of glasses)

WHEN

Contract Number: N68335-20-C-0288 **Ending on:** January 13, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Finalize catalytic scrubber materials and filter KPP's w. NAVAIR	Low	KPP list	4	July 2020
Determine materials and testing methods	Low	Material list and testing method selection	4	October 2020
Experimentally examine performance of selected solutions	Low	Confirm materials and methods for testing and validation	5	April 2021
Design and fabricate Engineering Prototype (EP) Filter	Med	Confirm filter requirements to finalize design	5	July 2021
Test EP filter for performance validation	Med	Prototype demonstration and Final Report with test data	6	January 2022

HOW

Projected Business Model: Our goal is to maintain technical oversight of development of the technology platform and transition this technology to the fleet in an initial application working with a commercial manufacturer and Navy personnel to improve safety and productivity for Sailors and Marines.

Company Objectives: Commercialize the technology within the Navy, and more broadly within all of DoD. PCI plans a staged applications development and commercialization schedule aligning with the SBIR program, seeking spin-offs into various applications funded either by BAA's or other development programs.

The primary markets for this integrated high-efficiency photocatalytic oxidation and sorbent system will be for military and commercial aircraft OBOGS systems. The technology is initially targeted for application in the Navy for OBOGS equipped aircraft such as the F/A-18 Hornet/Super Hornet. Other Navy and Air Force OBOGS equipped aircraft will be addressed once the technology is proven for the initial Navy aircraft. There is also the promising potential for a spin-out into personnel protection equipment applications for contaminants and viruses.

Seek commercial applications for license to appropriate PPE and filtration companies.

Potential Commercial Applications: Breathing air filtration masks, vehicle and building air filtration. To date, PCI has designed, developed, and delivered several regenerable adsorber units to AFRL and NASA. These units have been tested for removal of water, of Toxic Industrial Chemical (TIC) simulants and of CO2/trace contaminants, and the performance results indicated good sorption capacity with efficient regeneration.

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aanderson@precision-combustion.com 203-287-3700 X290

Energy & Power Technologies (Navy FST Booth: 3 August)



Company	Topic	Project Title
Piasecki Aircraft Corporation	N17A-T007	Piasecki Lightweight Sensor Pod
Candent Technologies Incorporated	N132-086	Prime Power System Development for Active Denial Technology (ADT) and High-Power Radio-Frequency (RF) Systems

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 264, Air ASW Systems

Transition Target: Air Platform Sensors

TPOC:
(301)342-2034

Other transition opportunities:



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WHAT

Operational Need and Improvement: With movement toward Unmanned Aerial Vehicles (UAV) as new platforms for sensors and weapons, the practice of a design for each new sensor is unrealistic and highlights the need for an innovative and lightweight, modular solution. All systems to be carried by UAV's must carefully consider the size and weight restrictions imposed by the UAV's limited capacities. Novel approaches for mounting sensor components, and system packaging, and assembling could lead to the use of extremely light weight, modular sensors. Versatility, cost of manufacture, vibration dampening, strength, durability and low coefficient of thermal expansion are all important considerations of a new, light weight packaging approach.

Specifications Required: Maintain an internal temperature of 70° F +/- 10 °F; Maintain positive nitrogen pressure; Modular mounting of payload; Pod must weigh less than 125 lb empty; Pod must be able to continuously reject 2000 watts of heat when sensor is in operation; Must attenuate vibrations to payload.

Technology Developed: Developed a Lightweight Sensor Pod for the MH-60R Capable of Supporting NAVAIR Provided Electrical Equipment, Including a Laser System
High Strength-to-Weight (125 lb Weight Empty, 175 lb Payload)
Highly Effective Heat Rejection Without Direct Contact to Ambient Air
All Key Technologies Tested in Lab Prior to Deployment

Warfighter Value: Optimal Sensor Environment and Sensor Viewing to Provide Superior Sensor Performance
Detection of Naval Mines Utilizing NAVAIR Deep Penetrating Laser System
High Geo-physical Detection by Mitigation of Error Caused by Vibration
Reconfigurable Electronic Enclosure with Environmental Protection and Temperature Control

WHEN

Contract Number: N68335-19-C-0012 **Ending on:** January 15, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
CONCEPTUAL DESIGN	N/A	TRADE ON COMPETING REQUIREMENTS AND VALIDATE APPROACH	2	December 2018
PRELIMINARY DESIGN REVIEW	N/A	MODEL AND PRELIMINARY ANALYSIS	2	September 2019
CRITICAL DESIGN REVIEW	N/A	DRAWINGS AND ANALYSIS	2	January 2020
MANUFACTURING AND ASSEMBLY	Med	TESTWORTHY ARTICLE	2	October 2020
TESTING	Med	TEST PLANS AND REPORTS	3	November 2020
FINAL REPORT (BASE+OPTION)	Med	FINAL REPORT AND DELIVERY	3	January 2022

HOW

Projected Business Model: License design to OEM or low-scale in house fabrication.

Company Objectives: Develop a multiple use electronic store for a variety of payloads to serve DOD and other customer needs.

Potential Commercial Applications: Intelligence, Surveillance and Reconnaissance (ISR) or test article for novel systems developed at research institutions, terrain mapping, urban mapping and planning, and agriculture and forest mapping.

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MCSC-PRR-3595

Topic # N132-086

Prime Power System Development for Active Denial Technology (ADT) and High-Power Radio-Frequency (RF) Systems
Candent Technologies Incorporated

WHO

SYSCOM: MARCOR

Sponsoring Program: Joint Intermediate Force Capabilities Office (JIFCO), formerly Joint Non-Lethal Weapons Directorate (JNLWD)

Transition Target: Active Denial Technology (ADT) Non-Lethal Weapon (NLW)

TPOC:

sbir.admin@usmc.mil

Other transition opportunities:

Shipboard Power, micro grid power, hybrid electric propulsion

Notes:

(HEL) High Energy Laser
(MEP) Mobile Electric Power
(SWaP) Size, Weight, and Power
(MTBF) Mean Time Between Failure

Technology is highly scalable in the range of 50kW to 1500kW, and is also suitable for commercial applications, such as distributed generation, micro grid power, standby and baseline power, as well as marine and ground system hybrid electric propulsion



Candent Turbogenerator

- **Rating:** 250kW (300kW max.)
- **Rated Voltage:** 345/700VDC, +
- **Fuel Burn*** 20 GPH
- **Dimension (in.)** 28x28x50
- **Power Density** 500 W/lb

Image Courtesy of Candent Technologies

WHAT

Operational Need and Improvement:

Non-Lethal Weapons Program seeks to develop a small, lightweight, prime power system for Directed Energy Weapons (DEW) capable of producing large amounts of power in very short but numerous bursts.

Specifications Required:

- Average Power Output: 150 kW to 250 kW
- Fuel Type: JP8 Fuel
- Fuel Efficiency: 4.6 kWh/kg at 75% load factor, > 4 kWh/kg at 25% load factor
- Operating Temperature Range: -50° C to +50° C
- Output Voltage: 345 VDC +/- 10%
- Output Specific Power (Volume): Threshold: 6,000 W/ft³; Objective: 16,000 W/ft³
- Output Specific Power (Weight): Threshold: 100 W/lb; Objective: 500 W/lb
- Efficiency: 96% efficient generator head

Technology Developed: Candent has developed advanced, high efficiency small gas turbine and high speed generator technology, integrated with state of the art microtube heat exchangers, which create an enabling technology prime power source for Directed Energy Weapon systems.

Warfighter Value:

Provides a non-lethal escalation of force options, avoiding casualties & collateral damage as well as:

- Reduced weight and size vs current diesel gensets, while meeting SWaP
 - o 90% Weight Reduction (9300 lbs. down to 950 lbs.)
 - o 80% Size Reduction (x cubic ft down to y cubic ft)
- Lower operating costs, on-condition maintenance
- Reduced noise and IR signature transportation costs
- Higher MTBF and TBO (Increases Operational Availability)
- Improved mobility and transportability

WHEN

Contract Number: M67854-19-C-6500 **Ending on:** March 26, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
SBIR Phase II Base – System Design	Low	SWaP Design Compliance	TRL 4	4th QTR FY16
SBIR Phase II Option – Prototype Fabrication & Demo	Med	In a relevant laboratory environment, successfully demonstrated advanced high speed generator	TRL 5	4th QTR FY20
SBIR Seq Phase II – Heat Recovery & Control System Integration	Med	In relevant environment successfully demonstrate system performance and efficiency	TRL 6	2nd QTR FY21
SBIR Phase III – Production Configuration Prototype Testing	Med	Successfully conduct production qualification and DT&E	TRL 8	1st QTR FY23
EMD – Milestone B	Med	Full Spec Compliance	TRL 9	1st QTR FY24

HOW

Projected Business Model: is based on three strategic premises; 1) to leverage the strengths of the company; 2) to outsource the manufacturing function; and 3) to partner with Prime(s)

1. Leverage of Strengths. Our greatest strength is the breadth of knowledge and expertise of the Candent team with over 80 years' experience in aerospace and defense industry, such as engineering, management, manufacturing, supply chain, logistics support, and business development.
2. Outsourcing Manufacturing: Substantially lowering our overhead rates and avoiding the need for capital infusion to establish a manufacturing facility will allow Candent to focus on our strength: engineering, assembly, and testing.
3. Partnering: We want to partner with Tier 1 Directed Energy Weapons and power generation, suppliers while maintaining our focus on R&D on prime power generation.

Company Objectives:

Fully develop, test, and deliver our 250kW Turbogenerator for integration into Non-Lethal Weapon Program of Record, and continue to develop power and propulsion derivatives for other military applications and commercial markets.

Potential Commercial Applications: The versatility and scalability of the Candent system makes it highly compatible with commercial power generation applications, such as standby and baseline power for systems up to 1500kW, distributed generation/micro grids, mobile electric power, and marine vessel service/auxiliary power, as well as hybrid electric propulsion systems for land or marine vehicles

Contact: Hernando Munevar, President & CEO
hmunevar@candent-technologies.com 317-336-4478

Ground and Sea Platforms (Navy FST Booth: 3 August)



Company	Topic	Project Title
Great Lakes Sound & Vibration, Inc.	N181-039	Common Unmanned Underwater Vehicle (UUV) Stern Launch and Recovery System
Pacific Engineering, Inc	N171-072	Light Weight Composite Components for Naval Systems
Response Technologies, LLC	N182-121	Low-Density, Low-Volume Explosion Suppression Material for Aircraft Fuel Tanks
RE2, Inc.	N151-066	Vanilla UAS Capability Overview
Sphere Brake Defense, LLC	N173-142	Advanced Tactical Sphere Brake

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NAVSEA #2020-0354

Topic # N181-039

Common Unmanned Underwater Vehicle (UUV) Stern Launch and Recovery System
Great Lakes Sound & Vibration, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PMS 420, LCS Mission Modules Program Office

Transition Target: Launch and Recovery (L&R) device that can accommodate a variety of Unmanned Underwater Vehicles (UUVs) when installed aboard Littoral Combat Ship (LCS)

TPOC:
(850)235-5142

Other transition opportunities: The L&R device is not limited to the LCS ship class as it can be installed on any ship class with a well deck or crane capable of deploying and retrieving the recovery device. Other platforms include the Expeditionary Transfer Docks (ESD) / Expeditionary Sea Base (ESB)(PMS 385), America class Amphibious Assault Ship (LHA (R))(PMS 377), and San Antonio class Amphibious Transport Dock (PMS 317).

Notes: Our manufacturing plant is currently in production on several product lines for the US Navy LCS; the Multi-Mission Surface Combatant ship; the Joint Light Tactical Vehicle; and the Stryker armored vehicle, among others. GLSV would manufacture in-house our UUV L&R device for small and medium production volumes, and sell it directly to the US Navy or to the applicable LCS shipbuilders. An alternative, secondary approach is to license our solution to a large DoD prime for manufacturing of higher production volumes, if required.



Photo courtesy of U.S. Navy, 190903-N-NL576-006

WHAT

Operational Need and Improvement: The Navy is looking for a common solution to launch and recover a variety of UUVs from large to small, and that can operate from near the waterline (Freedom variant Littoral Combat Ship (LCS)) to high above the waterline (Independence variant LCS). The Navy needs a system for launching and recovering UUVs that are of a variety of sizes, weights, and shapes from a variety of ship platforms and waterline heights. Both variants of the LCS as well as the Expeditionary Fast Transport (EPF) ship utilize stern launch and recovery of watercraft, versus using a moon pool or side mounted launch and recovery system.

Specifications Required: The Navy has an objective to launch and recover UUVs in sea states through sea state 3 in accordance with STANAG 4194:1983. Supported platforms potentially could have a freeboard anywhere from near the waterline to as high as 15' above the waterline. The L&R device will also need to avoid damaging sensitive areas on the UUVs.

Technology Developed: The GLSV team has developed a modular, adaptable L&R system that is capable of fast-tempo L&R of various UUVs from various ship classes in sea states through sea state 3. The L&R device is deployed or recovered from a well deck or crane and remotely maneuvered for UUV L&R. The recovery device is equipped with an electronic propulsion system and a vision system for the operator to successfully retrieve the various UUVs remotely. A 1/4 scale model has been successfully testing in a wave tank and open water conditions.

Warfighter Value: With a common, modular L&R device, the Navy will benefit from reduced life cycle costs by having multiple ships perform multiple functions and also a cost savings due to standardization of a system. The common L&R device can also be used to improve any logistical challenges by providing a solution for high-tempo L&R of a wide range of UUVs.

WHEN

Contract Number: N68335-19-C-0623 **Ending on:** July 16, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Scale Model Prototype Build and Testing.	Med	Testing of scale model prototype in wave tank to verify design concept.	4	March 2020
Dynamic Simulation Modeling	Med	Conducting multi-domain dynamic simulation modeling to demonstrate feasibility	4	July 2020
Controls Development and Testing	Med	Testing the remote control system using a full scale surrogate L&R device in a relevant environment	5	October 2020
Build and test of simplified Full Scale Prototype	Med	Testing a full scale model to verify sub-systems in a relevant environment	6	July 2021
If Option exercised, Build, test, and deliver a Full Scale Prototype	Med	Field testing a full scale prototype UUV Recovery Device in an operational environment	7	July 2022

HOW

Projected Business Model: GLSV Inc. is a small business established in 1996 to provide complete turnkey solutions to solve problems for the North American defense market. GLSV is a full-service engineering and manufacturing company with a strong background in marine and naval systems, defense ground vehicles, and off-highway markets. Our experience includes structural design and analysis of a L&R crane, stern door ramp design and analysis, and development of shipboard components and subsystems to meet MIL-S-901D requirements for Navy shock. GLSV maintains a strong analytical skill set complemented by our practical engineering know-how to develop solutions and products that we manufacture and field for US Navy and Army applications.

Company Objectives: GLSV would like to meet key customers in the Navy, as well as key stakeholders who can assist us with qualification and integration issues. GLSV would also like to meet Navy representatives from the LCS program office and other ship platforms to discuss potential applications. In addition, the National Oceanic and Atmospheric Administration (NOAA) utilize UUVs on several of their exploration ships; consequently, GLSV would like to explore opportunities with them and potentially enable them to operate said UUVs in higher Sea States.

Potential Commercial Applications: A lucrative market currently exists for at-sea launch and recovery of Autonomous/Underwater Unmanned Vehicles. Current commercial launch and recovery systems are often ship-specific and UUV/AUV-specific. Institutions such as WHOI and private industries supporting the petroleum industry all use UUVs/AUVs and conduct numerous launch and recovery operations every year. The ability to operate multiple systems from a common platform is seen as an advantage since it affords the operators flexibility of both ship design and AUV/UUV capability. There are multiple commercial markets that use UUVs and would benefit from a modular L&R device. Some of the commercial applications are offshore oil and gas, environmental monitoring, hydrography, and search and rescue.

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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0411

Topic # N171-072

Light Weight Composite Components for Naval Systems

Pacific Engineering, Inc

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS 5.0 - Undersea Systems

Transition Target: FFG(X) guided missile frigate, Large Unmanned Surface Vessel (LUSV)

TPOC:
(202)781-2002

Other transition opportunities: PEI shaft technology can be applied to many DoD and Department of Homeland Security (DHS) programs, such as: Department of the Army watercraft, DoN surface combatants (to include unmanned and small surface combatants), and DHS United States Coast Guard surface ships.

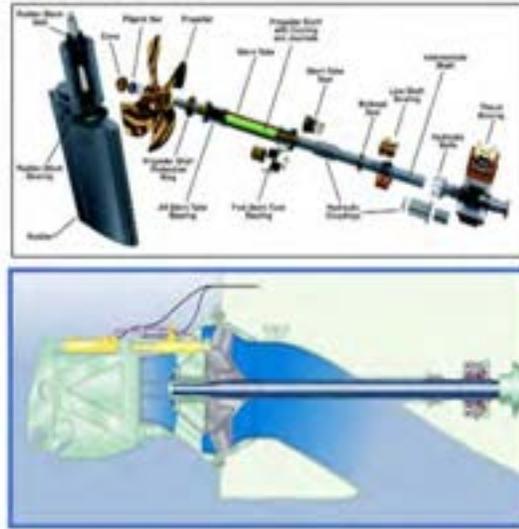


Image Courtesy of Wartsila Defense, Inc.

WHAT

Operational Need and Improvement: The primary objective of this SBIR effort is to develop light weight composite main propulsion drive shafts and gear box housings for the guided missile frigate (FFG(x)), guided missile destroyer (DDG), and guided missile cruiser (CG) systems. Develop a composite shaft for the Large Unmanned Surface Vessel (LUSV).

Specifications Required: Reduce weight and maintenance life cycle costs.

Technology Developed: Filament-wound composite main propulsion system drive shafts and the metal-to-composite joint design needed to attach the required flanges.

Warfighter Value: Reduces weight by 50%, reduces the outside diameter of the shafts, and removes the need for preservation or removal due to the non-corrosive material.

WHEN

Contract Number: N68335-19-C-0174 **Ending on:** November 30, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Selection of fabric and resin with incorporated nano materials	Med	Current seals weigh in excess of 500 lbs.; PEI composite units to be 40% lighter	6	November 2020
Alignment ring and seal housing composite configuration	Med	Main seal air leakage rate specification (5 PSIG/15 Min)	6	November 2020
Alignment ring and seal housing composite configuration	Med	Main seal water leakage past seal rate (1 Qt/Hour)	6	November 2020
Selection of fabric and resin with incorporated nano materials	Med	Reduce weight of existing shaft by 50%	6	November 2020

HOW

Projected Business Model: PEI has the in-house capability to build light weight composite drive shafts and gear boxes and has the ability to transition products to the fleet. Wartsila and Gibbs and Cox will assist in designing of the propulsion systems interface.

Company Objectives: Develop shafting technology that reduces corrosion, weight, and the life cycle costs of ship main propulsion components.

Potential Commercial Applications: Boats, yachts, jet skis.

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626-379-2282

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-830

Topic # N182-121

Low-Density, Low-Volume Explosion Suppression Material for Aircraft Fuel Tanks Response Technologies, LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO (A)

Transition Target: PMA 261 CH-53 Heavy Lift Helicopter

TPOC:
(301)342-6070

Other transition opportunities:
All land, sea, and air vehicles that utilize crash foam



Photo Courtesy of USMC

Notes:

IP: U.S. Patent Application No.: 16/510,465. Title: PROCESS OF MANUFACTURING RETICULATED FOAM PRODUCTS, USING ALTERNATIVE MATERIALS. Filing Date: July 12, 2019

WHAT

Operational Need and Improvement: The Navy has two Fuel Tank Explosion Suppression (FTES) methods for air vehicles: On Board Inert Gas Generating System (OBIGGS) and Explosion Suppression Foam (ESF).

- OBIGGS protects the fuel tanks internally by constantly generating inert (nitrogen) gas and supplying it to the fuel tank ullage space to maintain an oxygen depleted environment.
- ESF (urethane foam) protects by filling the fuel tank with reticulated foam and keeps a ballistically-induced or electrical failure-induced flame front and explosion from propagating throughout the fuel tank.

Currently, the Navy seeks to develop a lightweight fuel tank explosion suppressant that fits within a wide range of aircraft fuel tank geometries and is easily installed and removed

Specifications Required: An innovative FTES material to replace ESF, while meeting the explosion suppression performance properties, is needed.

- FTES material must not displace more than one percent fuel volume,
- must not retain more than one percent fuel volume in any given fuel tank
- new FTES material must have a uniform nominal density not to exceed 0.9 pounds per cubic foot
- should perform with JP-4, JP-5, JP-8, and commercial Jet A fuels
- No toxicity hazard to personnel who maintain or come in contact with the FTES material can occur
- should be a 10-year maintenance requirement to check and remove
- Material color should be uniform throughout and cannot be blue, orange, yellow, or red

Technology Developed: RT's proof of concept materials is additively manufactured polymeric matrices. Phase I SBIR efforts demonstrated that the material can be manufactured at scale and showed very promising physical characteristics compared to the two controls.

Warfighter Value: - Lowers the weight of the foam and retained fuel by over 20%

- Reduces the amount of displaced fuel (e.g., lost fuel capacity) by over 50%.
- Delivers a 20% procurement cost reduction
- Doubles operating life due to fuel blend compatibility
- Improves the ease of installation and removal from aircraft fuel tanks

WHEN

Contract Number: N68335-20-C-0137 **Ending on:** January 21, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototypes	N/A	MIL-PRF-87260 B	4	April 2019
Improved Prototypes and DT&E	Low	MIL-PRF-87260 B	5	December 2020
Internal DT&E of Final Design	Med	MIL-PRF-87260 B	5	August 2021
Qualification	Med	MIL-PRF-87260 B	6	December 2021
OT&E	Med	MIL-PRF-87260 B	7	June 2022
Source Approval	Med	MIL-PRF-87260 B	8	December 2022

HOW

Projected Business Model:

RT seeks to manufacture and directly distribute FAUXM, our proprietary solution, by leveraging existing fuel cell relationships within the DOD, Primes and the Commercial Market. We expect to sell FAUXM via direct contracts, Purchase Orders (POs), and online ecommerce to commercial markets (B2B).

Company Objectives:

Potential Commercial Applications:

DOD: DLA, NAVAIR, USAF, Army CCDC, and ARL connections from existing work with A-10, H-60, H1, CH-53, FVL, FARA, and NGCV.

Primes: Sikorsky and Bell legacy, commercial and future aircraft.

Commercial Market: Automotive racing circuits

Contact: Ed Bard, President
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(401)585-5918

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-7504-20

Topic # N151-066

Underwater Dual Manipulator Inflatable (UDMI)

RE2, Inc.

WHO

SYSCOM: ONR

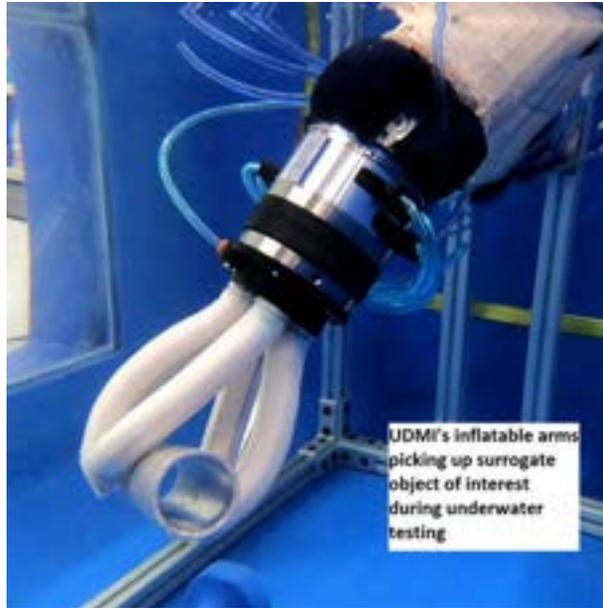
Sponsoring Program: PMS-408

Transition Target: Maritime Expeditionary Standoff Response (MESR) Program of Record

TPOC:

Mr. Brian Almquist
brian.almquist@navy.mil

Other transition opportunities: Low Observable / No Collateral Damage Neutralization of Underwater Mines and Waterborne Improvised Explosive Devices Future Naval Capability



WHAT

Operational Need and Improvement: Develop an inflatable underwater dexterous manipulation system that minimizes impact on energy needs and electromagnetic signature of Remotely Operated Vehicles (ROVs) to perform counter mine and Water-Borne Improvised Explosive Device (WBIED) missions.

Specifications Required: * Deployable/inflatable as needed

- * Lifts objects weighing up to 25 lbs
- * Lightweight
- * Precise wrist control positioning under tele-operation
- * 7 Degrees of Freedom (DOF)
- * Single or dual arm configuration

Technology Developed: * Inflatable arm, gripper, and actuators
* Environmental seawater inflates the structure and powers the hydraulics
* Pressurized membranes using compliant, elastomeric materials
* Fluidic peristaltic roll joint enabling continuous rotation and precision motion
* Torque: 8 ft-lbs; Joint speed 30 degrees/second
* Tele-operated control system

Warfighter Value: * Inflatable arms with natural compliance decrease possibility that contact with or near a suspicious device could cause a detonation.

- * Increases safety when working in close proximity to suspicious devices moving unpredictably in water columns.
- * Minimizes additional size, weight and power (SWAP) needs and reduces electromagnetic signature created by adding manipulators to ROVs.

WHEN

Contract Number: N68335-17-C-0046 **Ending on:** December 18, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial prototype build and underwater testing in lab	N/A	Successfully demonstrated proof-of-concept	4	2nd QTR FY19
Revised prototype build and underwater testing in lab	N/A	Passed initial underwater testing	5	2nd QTR FY20
Demonstrate underwater operations in lab	Low	Successful demonstration of UDMI capabilities	6	1st QTR FY21

HOW

Projected Business Model: Develop and manufacture manipulators and payloads for Programs of Record, selling them either directly to the DoD or to Defense Prime Contractors.

Company Objectives: RE2, Inc. designs, develops, and integrates intelligent mobile manipulation systems and payloads with human-like performance for unstructured ground and underwater environments.

Potential Commercial Applications: * Oil and gas industry

- * Other underwater applications requiring highly dexterous manipulators integrated with smaller ROVs

Contact: Jonathan Brown, Business Development Manager
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MCSC-PRR-3594

Topic # N173-142

Advanced Tactical Sphere Brake
Sphere Brake Defense, LLC

WHO

SYSCOM: MARCOR

Sponsoring Program: Program Executive Officer Land Systems

Transition Target: Amphibious Combat Vehicle

TPOC:

sbir.admin@usmc.mil

Other transition opportunities:

System has applications for all heavy tactical vehicles (and trailers) to include Medium Tactical Vehicle Replacement (MTVR), Logistic Vehicle System Replacement (LVSR), Stryker (Army), and Family of Medium Tactical Vehicles (FMTV) among others.

Notes: The Bolt-on Sphere Brake Kit for Pneumatic and Air-Over-Hydraulic (AoH) Tactical Vehicles (pictured) meets or exceeds current performance specifications relating to mobility, fuel economy, and safety, but with a smaller physical footprint (size/weight), and revolutionary advantages in maintenance and logistics support that will have a dramatic effect across the Marine Air-Ground Task Force (MAGTF) -- this braking kit has already been tested by one of the preeminent American truck manufacturing companies. The US Army has recently awarded SBD with a Sequential Phase II SBIR project to scale the Sphere Brake Kit for the Stryker and FMTV platforms.



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WHAT

Operational Need and Improvement: Several Marine Corp vehicles are experiencing brake system problems across the fleet; specifically, there is significant corrosion of the drum and brake actuation mechanism from water and debris accumulating in the inner brake drum surface. This problem impacts safety, performance, operational availability, maintenance time, logistics delay time and money. Furthermore, drum brakes are heavy. They are made of mild to medium strength grey iron and the entire assembly (drum, pads, hardware, chambers) can weigh on order of 400 pounds each. Under brake application, the brake pads expand out from the axle towards the drum surface longitudinally, inducing mechanical fade under severe heat. Their actuators as well as the entire assembly make drum brakes susceptible in tactical vehicle applications.

Specifications Required: New brake technology on the current horizon appears promising where innovative designs will enable very high torque and are significantly lighter, smaller, and reliable while producing more brake force; these have significant performance advantages towards safety as well. New brake technology offers tactical advantages in that they can be inspected and maintained in the field, possibly without wheel removal and replacement. Specifications include: must be able to service and replace brake pads without removing wheels; must weigh 30% less than existing brake systems; must bolt-on to existing wheel-ends, axles, and wheel hubs; and must be cost competitive with existing brake systems in the market.

Technology Developed: The pneumatic and AOH sphere brake kit bolts on to existing wheel-ends without any modifications to the axle, wheel, or hub. The brake weighs >50 pounds less per wheel-end than existing brakes and it's the only brake in any market that doesn't require wheel removal to change brake pads.

Warfighter Value: The sphere brake kits provide unprecedented reliability, maintainability, and safety to the Warfighter that existing brakes cannot match. The collective return of investment yields thousands of dollars of savings per mile equating to millions of dollars in savings over the life of a vehicle program.

WHEN

Contract Number: M67854-19-C-6515 **Ending on:** July 11, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
FMVSS 121 Section 6 Certification	Low	PASS	6	4th QTR FY20
Sequential Phase II US Army	Med	Contract Award	7	4th QTR FY20
FMVSS 121 Stopping Distance Track Certification	Med	PASS	7	3rd QTR FY21
TOP 2-2-608 Mountain Brake Descent Certification	High	PASS	7	3rd QTR FY21
Program Transition	High	LRIP	7	1st QTR FY22

HOW

Projected Business Model: SBD is collocated in a 100,000 sq. ft. manufacturing facility operating a lean, agile supply chain to provide premium technology without the premium price. The technology will be developed, manufactured, and commercialized on ground tactical vehicles across agencies within the Department of Defense (DOD). Numerous Marine Corps and US Army programs have already expressed interest to transition the technology to several Programs of Record as a Prime. SBD has established relationships with several vehicle Prime Contractors who have also expressed interest in transitioning the technology to new vehicle platforms as a Tier 1 supplier. After successful certification and fielding within the DOD, SBD will transition the brake technology to same class commercial vehicles. SBD could license the technology to existing brake manufacturers.

Company Objectives: Over the next 5 years the company will usher in disruptive wheel-end and drive train technology for multiple industries on a global scale providing unprecedented safety, efficiency, and cost savings for all customers. The near term goal is to replace existing foundation braking across multiple ground tactical vehicles. The long term goal includes expanding wheel-end product offerings to provide holistic solutions to vehicle integrators within and external to the DOD through companion technologies and advanced material composites.

Potential Commercial Applications: Where there are brakes, there can be sphere brakes. Numerous vehicle platforms across different industries face similar challenges relating to reliability, fuel efficiency, and maintainability. The company will continue developing sphere brake kits for the commercial vehicle industry, racing, rail, and e-mobility industries. Numerous iterations of the sphere brake are already in development within each industry through existing original equipment (OE), government, and academic partnerships. SBD has partnered with Casey Rail to develop a new Sphere Brake Rail Kit for freight rail cars. A new Hydraulic Sphere Brake has been developed and is currently going through field testing on Cleveland CycleWerks' new Falcon Black electric motorcycle for 2021 commercial production. In both heavy and lighter applications, the sphere brake delivers the same value to commercial vehicle fleets that it delivers to programs within the DOD.

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aaronlewis@spherebrakedefense.com

(814) 898-4321 x266

Human Systems (Navy FST Booth: 3 August)



Company	Topic	Project Title
BGI LLC	N181-026	Data Science Based Aircrew Performance Assessment Tools
Charles River Analytics Inc.	N162-124	Simulating Training Results to Understand Differing Effects of fidelity on Learning (STRUDEL)
Charles River Analytics Inc.	N172-132	Adaptive Training Protocols (ATP)
Charles River Analytics Inc.	N151-077	Strengthening Health and Improving Emotional Defenses (SHIELD)
2 Circle Consulting, Inc	N181-026	Reconstruction and Assessment of Proficiency in an Integrated Debrief

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NAVAIR 2020-850

Topic # N181-026

Data Science Driven Aircrew Performance Measurement and Proficiency System
BGI LLC

WHO

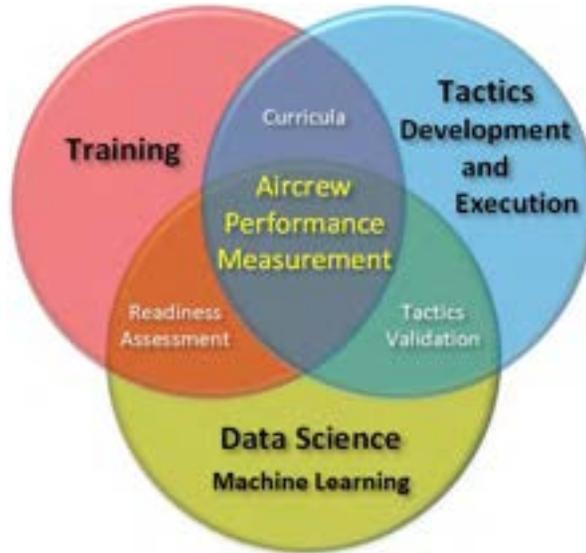
SYSCOM: NAVAIR

Sponsoring Program: PMA-298

Transition Target: PMA-205
Integrated Training Facility, NAS Fallon, via Next Generation Threat System (NGTS)

TPOC:
(407)380-4773

Other transition opportunities: Any structured training or operational environment that supports performance data collection, including live training ranges, virtual simulators, and Virtual Reality/Augmented Reality training environments.



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WHAT

Operational Need and Improvement: As a means to improve proactive decision making, Navy leadership has emphasized leveraging data-driven analytics which enable predictive solutions and aid in proficiency tracking. Assessing training performance is a critical domain where data science technology provides a means to increase the effectiveness, accuracy and efficiency of the debrief. Instructors are often challenged with not having enough time to conduct a rigorous and detailed evaluation of each flight, negatively affecting the quality of performance evaluations. Current practice is subjective and is hampered by a time-consuming process. An automated mechanism to pre-process and fuse multiple data sources for assessment and tracking of warfighting capabilities would alleviate this burden.

Specifications Required: 1) Data interfaces for consumption and processing of a range of disparate data sources used in LVC training systems
2) An architecture and process for linking available data sources to aircrew performance
3) Scalable functionality to support individual, team, and multi-team aircrew compositions and mission sets
4) An intuitive user interface to facilitate data synthesis by a human-in-the-loop and automated displays

Technology Developed: BGI's Aircrew Performance Assessment (APA) Tool measures aircrew performance and quantifies readiness, allowing trending and assessments across the effects chain. APA is an innovative solution for evidence-based training to improve instructor efficiency and training quality. A Dynamic Performance Assessment Model (DPAM) provides tools for performance measurements and kill chain construction. DPAM is integrated as an extension of PMA-205's Next Generation Threat System's (NGTS) Analysis and Reporting Tool (ART), available in many training systems. Human in the Loop (HITL) approaches reduce complexity while limiting human input to objective aspects of the mission.

Warfighter Value: APA processes large amounts of data to quickly generate reports highlighting the execution of Tactics, Techniques and Procedures (TTPs) to support instruction and remediation immediately following a training exercise. The algorithms used have been designed and reviewed by qualified instructors, and the software is extendable to new and updated missions and TTPs. Automated assessment minimizes subjective evaluation and provides consistent highlighting of key training points, based on approved doctrine, to develop more effective warfighters. Training effectiveness and return on training investments can be quantified via objective, evidence-based performance measurements.

WHEN

Contract Number: N68335-19-C-0534 **Ending on:** June 25, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype complete; Air-to-Air (A/A) missions implemented	Low	Ability to support debrief of Offensive Counter Air and Defensive Counter Air training exercises	5	January 2021
Integration into NGTS baseline	Low	Completion of functional tests	6	January 2021
Air-to-Surface (A/S) missions implemented	Low	Ability to support debrief of A/S training exercises	6	June 2021
Integration into PMA-205 ITF	Med	Completion of acceptance testing	7	September 2021

HOW

Projected Business Model: BGI is an innovative, veteran-owned business, merging the expertise of engineers, data scientists, and operational analysts to best support the warfighter. While the APA tool is currently focused on a particular user community, the technology that underlies the functionality has much broader application. BGI is seeking additional users of structured training environments with measurable performance parameters, with whom to collaborate and apply this technology to optimize trainee readiness assessment and training effectiveness. It is particularly applicable to virtual or augmented reality training systems that provide a high degree of access to measure student actions and reactions to environmental stimuli.

BGI favors establishing partnerships with government customers and major prime contractors to continue to evolve technology over simple licensing of existing products.

Company Objectives: BGI has a demonstrated capability to collaborate with end-users to understand operational problems and then develop optimized tools to address them. BGI is seeking to extend the APA Tool into a comprehensive suite of tools that support not only assessment of trainee readiness, but also allow assessment and optimization of doctrine and application of advanced techniques, such as machine learning, to enhance knowledge via discovery of latent relationships and measures within critical effects chains.

Potential Commercial Applications: APA technology is equally applicable to commercial advanced training applications, including commercial aviation training, law enforcement tactical training, and medical training simulations. In each of these industries, BGI will target commercial companies that deliver training solutions requiring structured training environments with measurable performance parameters.

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ONR Approval #43-7504-20

Topic # N162-124

Simulating Training Results to Understand Differing Effects of fidelity on Learning (STRUDEL)

Charles River Analytics Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Live Virtual Constructive

Transition Target: Any simulations/simulators that provide training of interest to Navy and/or Marine Corps (e.g., maintenance tasks).

TPOC:

Dr. Ray Perez
ray.perez@navy.mil

Other transition opportunities: The recommendation engine can guide both training curriculums and training system acquisitions for groups such as NET-C and NAWC-TSD. Both the maintenance troubleshooting tutor and the learner models could expand the offerings in a program such as C-ARTS. The learner model is also a powerful tool to integrate into programs that guide personalized training, such as PAL3. This training software could be part of a package with new systems, such as the AN/SYM-3 Condition-Based Maintenance (CBM) system from Mikros Systems Corp., where it would provide training tools to learn how to use and troubleshoot the system.

Notes: Charles River Analytics has had recent success providing maintenance training systems, including completing a final Government Approval Test in July 2019 for MAGPIE, our TRL-9 intelligent virtual maintenance trainer (IVMT) being developed under a Phase III USAF SBIR. STRUDEL expands the maintenance training capabilities that Charles River Analytics has to offer.



<http://navylive.dodlive.mil/files/2013/01/130109-NZZ999-001.jpg>

WHAT

Operational Need and Improvement: The Navy needs a scientifically sound method for determining how much realism is needed to train a specific task, which is critical for simulator and simulation design and development. Currently there are no systematic empirically based methods that provide meaningful direction to training developers to determine how much realism (e.g., fidelity requirements) is needed to train for mission effective performance. Fidelity related design decisions are motivated by the belief that the more accurately the simulation stimulates the human sensory system, the higher the probability that the system will provide effective training. As budgets tighten, it is critical that these systems are optimized for training effectiveness.

Specifications Required: This effort should generate software that provides direction for training developers. The learner model should help developers to determine the level of fidelity optimal for effective training and interface design, and the software developed under this effort will provide a low-cost, adaptable tutoring system that can maximize benefits in the early stages of learning. The end result of this effort could generate clear and concise guidance that would enable subject matter experts to develop simulation-based training that is mission effective. To this end, this SBIR effort seeks an innovative software tool that can assess and validate the efficacy of simulation-based training technologies. This software tool, and any associated hardware required to run the software, will be used to evaluate current Navy simulator training and future simulation training design and development.

Technology Developed: STRUDEL offers a training recommendation engine; a lightweight, tailorable tutoring system; and guidelines for training schedules from our skill learning models. The STRUDEL toolset provide low-cost, powerful learning tools that help optimize training in programs such as C-ARTS; determining how much realism is needed.

Warfighter Value: The STRUDEL toolset will help drive optimizing training schedules for the Warfighter. This means the Warfighter won't have to waste time on training on material they have already learned and will receive the appropriate amount of training that they can feel confident carrying out their duties. This is especially true in training that requires learning how to use or maintain equipment, where STRUDEL will be able to provide lower fidelity training so the Warfighter can practice on simulations of the equipment and maximize the learning benefits when they finally access the equipment itself.

WHEN

Contract Number: N00014-18-C-7015 **Ending on:** October 30, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Troubleshooting Skill Tree	N/A	Skill Tree that serves as basis of tutor	1	4th QTR FY18
Troubleshooting Tutor	Low	Usable tutor accessible over web interface	6	4th QTR FY20
Fidelity and Learning Model	Low	Functioning model instantiated in software	5	1st QTR FY21
Human Troubleshooting Performance Data	High	Complete data collection on human fidelity experiment	3	1st QTR FY21
Maintenance System Integration	Med	Integrate actual Navy system (e.g., Aegis radar) into tutor	8	TBD
Learning Model Integration into Existing Training	High	Integrate learning model into training curriculum plans	7	TBD

HOW

Projected Business Model: Our expertise in Government technology transition includes licensing, custom development for Government primes, and joint-venture enterprises. For STRUDEL we plan to both license the recommendation engine, the tutor, and learner model, as well as team with Government primes to create custom tutors for their systems.

Company Objectives: Our objective for the FST is to connect with maintenance training providers, such as the Carrier-Advanced Reconfigurable Training System (C-ARTS) facility under PMS 378, CVN 78 Class Program and the Personal Assistant for Life Long Learning (PAL3) effort currently funded by ONR. We also seek to connect with equipment providers, such as Mikros Systems, who provide prognostic maintenance systems, to offer a light-weight training option they could tailor and bundle with delivery of their systems. Our commercialization objective is to team with equipment or training providers in areas where the machinery used can be dangerous and expensive, such as manufacturing, to provide safe and effective training about how to maintain such machinery.

Potential Commercial Applications: In addition to the military market, the technology could have broad applicability in technical training and education, consumer learner products, and developers of augmented and virtual reality systems. These tools provide the most benefit for training in situations when high fidelity training or training on the physical equipment is expensive, dangerous, or even unavailable. We provide supplementary instruction that can maximize the benefit of high fidelity training by supplementing with relevant lower fidelity training upfront.

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Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-7504-20

Topic # N172-132

Adaptive Physical Training
Charles River Analytics Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Proposed FNC CMP-FY19-02 FitForce and High Intensity Tactical Training (HITT) Program from M&RA

Transition Target: Marine Corps Recruiting Command

TPOC:

Dr. Peter Squire
peter.squire@navy.mil

Other transition opportunities: While initial deployment is toward Marine Poolees in the Delayed Entry Program who must meet the fitness demands of Boot Camp, additional transition opportunities include the Marine Corps Force Fitness Instructor Program, the Marine Corps Martial Arts Program, and other fitness training programs in the Navy and other service branches.

Notes: The goal of the Adaptive Training Protocols (ATP) physical fitness training mobile app is to help Marines meet and exceed physical fitness requirements at all stages of their careers. Photo: Marine Corps Recruit Depot - A Marine recruit gives maximum effort during the pull-ups portion of the Physical Fitness Test aboard Marine Corps Recruit Depot San Diego. The PFT is used to gauge the endurance of recruits after the first phase of training. Photo By: Lance Cpl. Pedro Cardenas.



<https://media.defense.gov/2013/Apr/18/2000016296/-1/-1/0/130329-M-SG512-167.JPG>

WHAT

Operational Need and Improvement: Marine physical fitness is a core element of force readiness. To meet this goal, the Marine Corps has high physical and combat fitness standards, and it invests significant time and effort developing and maintaining physical training programs, such as the Marine Corps Martial Arts Program (MCMAP) and the Force Fitness Instructor (FFI) program; workout routines, such as High Intensity Tactical Training (HITT); and facilities. However, due to logistical necessities, current Marine physical training is often applied with a one-size-fits all approach: a 6'5" 225lb male Marine seeking to improve his running times may be given the same training routine as a 5'5" 125lb female Marine seeking to increase her flexed arm hang score. The current training does not change as a function of the Marine's specific physical fitness goals, nor is it tailored to an individual as they progress towards that goal, meeting and overcoming hurdles along the way.

Specifications Required: To effectively tailor fitness workouts to individual needs and goals requires: (1) better methods to automatically collect and transform data from an evolving device ecosystem into sufficiently rich and reliable physical assessments (e.g., identifying instantaneous state and trends over time); (2) translation of these assessments to actionable training interventions (e.g., recommended workouts, schedules, and assessments); and (3) presentation to Marines (including both trainees and Commanders) to meaningfully capture progress and purposefully shape behavior towards individual fitness goals.

Technology Developed: ATP incorporates a modular, wearable hardware suite based on COTS wearable sensors to collect rich and reliable data on physical performance. To compute individual training needs, ATP builds on Charles River's proven, in-house physiological data processing framework, Sherlock™. ATP prescribes each trainee an automatic, adaptive high-intensity workout, adapting physical training routines in response to automated assessments of individual Marines' training needs. ATP delivers this functionality via an intuitive mobile application for individual Marine users and a web-based dashboard for Commanders and trainers.

Warfighter Value: ATP is a scalable and affordable system to maximize the speed and effectiveness of Marine Corps physical training through automated adaptation of workouts based on data from COTS wearable sensors.

WHEN

Contract Number: N00014-19-C-2028 **Ending on:** April 30, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop and test physical fitness training regime to enable Marine Poolees to pass the Initial Strength Test	N/A	Research study completed with non-Poolee sample	3	2nd QTR FY19
Identify wearable sensors	N/A	Software integration with COTS chest-worn heart rate monitor	4	4th QTR FY19
Develop workout adaptation algorithms	Med	Machine learning algorithms implemented in software	4	4th QTR FY20
Assess usability and acceptance	Med	Data collected from Marine Poolees in the Delayed Entry Program	5	2nd QTR FY21
Develop mobile application	Med	App available from the Google Play Store	6	3rd QTR FY21

HOW

Projected Business Model: We see two approaches to transitioning and commercializing ATP. First, the app can be licensed and distributed directly to end users via conventional app stores. Second, the underlying technologies can be licensed to other commercial entities that will use them directly or incorporate ATP components as added functionality to their commercial products.

Company Objectives: Our short-term goals are to incorporate the ATP program within the workout routine that Marine recruiters recommend to their Poolees. We have received approval from the Marine Corps Recruiting Command (MCRC) to conduct research to assess usability and acceptability of the protocol with Poolees. In the long-term, we expect the ATP program to have tangible benefits for Marines, Sailors, and Warfighters across the DoD. Our secondary target is to make ATP available for individualized training for the physical fitness test (PFT) and combat fitness test (CFT) over the Marine career. Additionally, we will engage with programs such as Force Fitness Instructor (FFI) and Marine Corps Martial Arts Programs (MCMAP) to integrate adaptive training.

Potential Commercial Applications: We will seek to partner with companies in the fitness wearables and actigraphy services markets as potential licensees of this technology. While current commercial offerings provide granular assessment and real-time monitoring of fitness state, they provide little in the way of tailored goal setting and adaptive workout recommendations. ATP shall be amenable to commercial applications such as law enforcement, fire-fighting, emergency-responding, and other domains where not only physically demanding tasks are critical to job performance/safety and measured on a group basis but also where adaptive physical training would be economical and instrumental to performance improvement and injury/risk mitigation.

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Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-7504-20

Topic # N151-077

Strengthening Health and Improving Emotional Defenses (SHIELD)

Charles River Analytics Inc.

WHO

SYSCOM: ONR

Sponsoring Program: FNC - Accelerating the Development of Small Unit Decision Makers FY15

Transition Target: This technology will have broad applications in military as well as commercial settings where personnel are exposed to events that have a high probability of inducing stress and stress-related disorders.

TPOC:

Dr. Peter Squire
peter.squire@navy.mil

Other transition opportunities:

Psychological flexibility may be integrated into: 1) entry-level training, such as Basic School; 2) pre-deployment training curricula, such as the Infantry Immersive Trainer; 3) deployment to combat zones, administered by Combat Operational Stress Control (COSC) units; and 4) as part of re-acclimation programs at the end of a tour. In commercial settings, these solutions may be similarly integrated into existing programs or as part of daily activities.

Notes: Strengthening Health and Improving Emotional Defenses (SHIELD) is a mobile app that guides Warfighters through evidence-based methods of stress regulation, including breathing techniques, mindfulness-based stress reduction, muscle-tension body scans, and heart rate regulation training. Instruction, scheduling, and feedback are integrated with a smart watch or other sensor analyses to provide low-cost, easy-to-learn skills that flexibly integrate into existing training and exercise regimes.

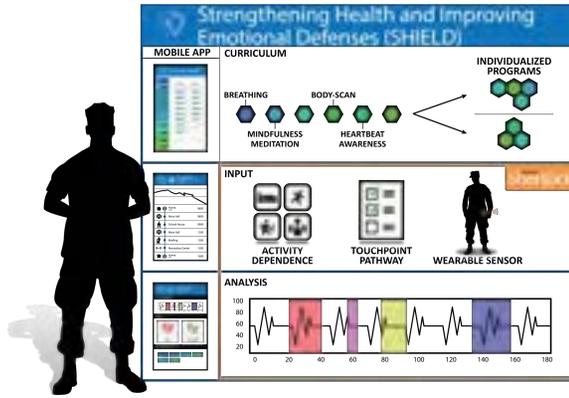


Image courtesy of Charles River Analytics

WHAT

Operational Need and Improvement: Psychological stress experienced by Marines can have negative consequences that reach beyond the individual; it affects job performance, personal relationships, and families. The inability to cope with chronic and acute day-to-day stressors, such as separation from loved ones or adjusting to the physical and mental demands of the Marine Corps, can leave individuals vulnerable to the harmful effects of stress. Teaching evidence-based strategies to promote psychological resilience before exposure to stress can mitigate its costly and often harmful long-term effects; however, existing Marine Corp programs for this training are costly, time consuming, and resource intensive.

Specifications Required: To maximize effectiveness, the Marine Corps requires a cost-effective, evidence-based psychological flexibility program that can be adaptively integrated into a variety of training approaches. This program must produce behavioral and physiological data to verify both short- and long-term effectiveness. A successful curriculum for training psychological flexibility to mitigate stress effects on Marines must meet three primary requirements: The training program must be driven by evidence and well-grounded scientific theory, while minimizing costly resource requirements. The program must collect and record stress levels using available sensor technologies to demonstrate efficacy. The program must flexibly integrate into existing Marine Corps training and exercise regimes.

Technology Developed: SHIELD is delivered within a mobile smartphone application designed to motivate Marines to set and meet their own goals (without significant external oversight), and provide a fast and easy mechanism for Marines, instructors, and commanding officers to monitor program participation, progress, and effectiveness. SHIELD instruction uses brief, self-paced instruction followed by practice that Marines can incorporate into other training, duties, and daily activities; the mobile application enables Marines to train independently.

Warfighter Value: SHIELD develops Marine psychological fitness, promoting healthy responses to adverse and stressful events. SHIELD provides: A novel, flexible training program that can smoothly integrate into a Marine's daily activities by combining components from multiple proven strategies; evidence-based stress metrics that enable comparisons across time, groups, and competing interventions, information, direction, and feedback provided through physiological sensors and contextual awareness to provide low-cost, easy-to-use physiological indicators of stress and psychological flexibility.

WHEN

Contract Number: N68335-17-C-0084 **Ending on:** August 28, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop psychological resiliency curriculum	N/A	Instructional videos produced featuring Marine Corps instructor	3	1st QTR FY17
Identify wearable sensors	N/A	Software integration with Garmin Fenix™ smartwatch	5	4th QTR FY17
Develop mobile application	N/A	App available for evaluation from the Google Play Store	6	2nd QTR FY19
Assess usability and efficacy	Med	Research study completed	7	2nd QTR FY21

HOW

Projected Business Model: SHIELD training does not require expert or dedicated instructors, or special hardware for sensing or intervention beyond what Marines typically possess under the USMC Bring Your Own Device (BYOD) program. Consequently, we see two approaches to transitioning and commercializing SHIELD. First, the app can be licensed and distributed directly to end users via conventional app stores. Second, the underlying technologies can be licensed to other commercial entities that will use them directly or incorporate SHIELD components as added functionality to their commercial products.

Company Objectives: Our short-term goals are to incorporate the SHIELD program within the daily routine of the Marines. We would like to work with Marine Corps Training and Education Command (TECOM) sub-organizations (e.g., Marine Corps University, Officer Candidates School, Marine Air-Ground Task Force, The Basic School) to identify appropriate strategies to effectively position our product within the Marine Corps. In the long-term, we expect the SHIELD program to have tangible benefits for Marines and Warfighters across the DoD, including the Marine RECON School, Community Counseling Centers, Defense Health Agency (DHA), and Navy Bureau of Medicine and Surgery (BUMED).

Potential Commercial Applications: Commercial applications in which these solutions are expected to be particularly effective include: disaster and crisis management, first responders, law enforcement, and humanitarian relief efforts. In particular, civilians in high stress jobs experience similar life stressors as military personnel. Therefore, we will target companies and entities in the healthcare and behavioral counseling domains, including insurance and e-health companies, as potential licensees of this technology.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-845

Topic # N181-026

Data Science Driven Aircrew Performance Measurement and Proficiency System
2 Circle Consulting, Inc

WHO

SYSCOM: NAVAIR

Sponsoring Program: Naval Aviation Training Systems and Ranges Program Office (PMA-205)

Transition Target: Strike Planning and Execution Systems Program Office (PMA-281)

TPOC:
(407)380-4773

Other transition opportunities:

RAPID is currently being developed in support of F/A-18 Air Warfare analysis, but is scalable to all platforms and missions.

Notes: Reconstruction and Assessment of Proficiency in an Integrated Debrief (RAPID) software provides automated performance assessment capability to all platforms, missions, and training environments. The tool applies a revolutionary, verified/validated methodology for tracking proficiency that has been used to inform training and resourcing decisions across the Naval Aviation Enterprise (NAE) for the last five years. While other systems stop at just identifying "what" occurred, RAPID enables root cause analysis of "why" it occurred by fusing data from multiple disparate sources and logically walking the user(s) through analysis and assessment of their individual and systems performance at the tactical level of execution. At the conclusion of each live, virtual-constructive, or distributed training event, RAPID reconstructs event outcomes, draws attention to critical points in the training, extracts learning points, develops a grade sheet for the user(s), and collects data on important metrics. The collected data is then processed using RAPID's ground-breaking artificial intelligence/machine learning techniques to inform all phases of execution (i.e., policy/planning, syllabi development, pre-event mission planning, real-time re-planning, and post-event remediation/training plan development).



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WHAT

Operational Need and Improvement: Navy leadership has expressed a desire to move from reactive decisions to proactive/predictive solutions leveraging data-driven analytics of warfighter proficiency. To aid in decision-making, systems are required that are capable of collecting, storing, fusing, analyzing, interpreting, and safeguarding proficiency data. Without these systems, warfighters lack the resources to conduct rigorous and objective performance evaluations and, instead, are hampered by manually intensive and time-consuming processes for performance assessment that often result in subjective ratings. This negatively affects the feedback provided to trainees as well as the quality/quantity of data that is fed back to decision-makers. A software tool that fuses data from multiple sources for human performance assessment and proficiency tracking would alleviate burdens on the warfighter and provide continuous data on aircrew performance and associated trends.

Specifications Required: The government requires software that pre-processes, fuses, and stores data from multiple sources for human performance assessment and proficiency tracking using existing hardware. The software must be scalable to support individual, team, and multi-team evaluations and requires the ability to parse and synchronize disparate data from live, virtual, and constructive (LVC) sources such as range instrumentation, aircraft systems, virtual simulators, and constructive applications. Finally, the software must include an intuitive human-machine interface that provides visualization tools to facilitate data synthesis by human-in-the-loop users and display automated data outputs.

Technology Developed: RAPID, which stands for Reconstruction and Assessment of Proficiency in an Integrated Debrief, is a software solution that automates the process used to trace mission outcomes to the tactical level of execution.

Warfighter Value: RAPID provides a common, single solution for reconstructing, analyzing, and assessing performance across all platforms, mission sets, and training environments (live, virtual-constructive, LVC, and distributed). The software enables after-action performance reviews that include details on effects chain execution in order to identify errors at the tactical level that trace to mission outcomes. This reduces the time required to assess performance and improves the quantity/quality of the data collected. Results are fed directly to the warfighter to improve tactical execution as well as leadership to support training and resourcing investment decisions.

WHEN

Contract Number: N68335-19-C-0544 **Ending on:** March 26, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Feasibility Study	N/A	Selection for SBIR Phase II	1	November 2018
Prototype Completed	N/A	Concept demonstration using dummy data	2	July 2019
Baseline Capability (Air Warfare)	Low	Integration of technical components capable of processing air warfare mission data	5	March 2021
Mission Expansion (Strike Warfare)	Low	Integration of technical components capable of processing strike warfare mission data	5	March 2022
Operational System	Med	Demonstration across all operational training environments	7	September 2023
Operational Mission Support	Med	Use during operational mission conditions	9	TBD

HOW

Projected Business Model: 2 Circle will license RAPID to the DoD for incorporation onto Joint Mission Planning System hardware and the Next Generation Mission Planning System as the primary application to support proficiency data collection, analysis, and integration. Technical assistance, platform/tactical subject matter expertise, and analytical support will be included in the license.

Company Objectives: 2 Circle is expanding RAPID technologies to include more platforms and would like to connect with program offices from across the DoD to become the premier provider of automated performance assessment and proficiency data analytical support.

Potential Commercial Applications: RAPID's advanced debrief capability, which integrates proficiency data/analysis into all phases of execution (pre-event, real-time, and post-event) provides a complete solution for conducting performance assessment across multiple industries. 2 Circle is currently developing commercial versions of RAPID to support the transportation and professional sports industries, among others.

Contact: Brad Gilroy, Project Manager
bgilroy@2circleinc.com 757-353-8806

Sensors

(Navy FST Booth: 3 August)



Company	Topic	Project Title
Beam Engineering for Advanced Measurements Company	N181-022	Laser Periscope Detection
Prime Photonics, LC	N162-097	Non-Contact Torque Sensor for Unmodified Composite Shafts and Non-Ferrous Metal Shafts
Q Peak, Inc.	N141-008	Multi-Color Laser

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-857

Topic # N181-022

Laser Periscope Detection

Beam Engineering for Advanced Measurements Company

WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO (A), PMA-299

Transition Target: MH-60R

TPOC:
(301)342-3378

Other transition opportunities: P-8, DDG-51, CVN



<https://www.navy.mil/management/photodb/photos/200627-N-CU072-1013.JPG>

WHAT

Operational Need and Improvement: Detection of periscopes masts, and proper discrimination to avoid false alerts, must be done rapidly before the mast is lowered. This system is fast, passive, neutral SWaP impact and not susceptible to countermeasures.

Specifications Required: The technology does not depend on optically-augmented returns from the periscope optics and is not subject to well-known countermeasures based on spectrally selective filtering or on polarization filtering within the threat periscope.

Technology Developed: An electronically-scanned periscope detection system is being developed utilizing breakthroughs in laser systems, gated imagers, and electronic optical path switching to enable detection of periscopes at long range, and discrimination of periscopes from clutter objects based on high-resolution imaging of periscopes and clutter, without the use of conventional optical gimbals. Electronic switching of the angular location and the size of the field of view (FOV) of the gated imager electronically combined with electronic switching of the beam divergence and of the pointing direction of the laser illuminator allows for fast and light-weight systems.

Warfighter Value: Rapidly detect and discriminate periscopes. The system is not susceptible to countermeasures due to the periscope detection system being outside the FOV of the periscope. The approach leverages existing deployed Navy airborne and shipborne radar systems that are capable of detecting threat periscopes, and provides an independent and unambiguous identification capability. It also provides an autonomous search capability independent of radar assets.

WHEN

Contract Number: N68335-20-C-0156 **Ending on:** February 14, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Fabrication / tests of beam deflector	Low		5	October 2020
Fabrication and tests of FOV steering system	Med		5	February 2021
Fabrication and tests of breadboard illuminator beam shape control system	Low		5	May 2021
Software and electronics development for laser integration with gated imaging system	Med		5	October 2021
Integrating imager and telescope with beam control and laser illuminator systems	Low		5	June 2022
Field testing the system from the seashore with simulated periscope	Med		5	February 2023

HOW

Projected Business Model: The Laser Periscope Detection System will be integrated with existing or planned future laser systems, including Electro-Optical and Infrared (EO/IR) systems

Company Objectives: BEAM offers advanced optical technologies and materials based on the expertise of its world-renowned founders and researchers in nonlinear- and electro-optics, lasers and photonics, liquid crystals, polymers, composites and complex materials, solving extraordinary problems in optics.

Potential Commercial Applications: All electronic beam steering and shaping systems would allow developing thin and compact LiDARs to be used in numerous auto-navigation systems (cars, drones, robots) as well as carry out search and rescue operations at sea.

Contact: Anna Tabirian, Vice President, COO
anna@beamco.com (407) 734-5222

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

NAVAIR 2020-725

Topic # N162-097

Non-Contact Torque Sensor for Unmodified Composite Shafts and Non-Ferrous Metal Shafts

Prime Photonics, LC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-265

Transition Target: F/A-18
Hornet/Super Hornet

TPOC:
(301)757-2504

Other transition opportunities:

Commercial rotorcraft and shipboard would benefit from a reliable non-contact torque measurement solution. There are also numerous applications where non-contact torque measurement would be beneficial, to include industrial, power generation, mining, agricultural and automotive industries. The market includes both troubleshooting/diagnostic of drivetrain issues and long-term monitoring for early detection of drivetrain problems.



US Navy photo, https://www.navy.mil/view_image.asp?id=173195

WHAT

Operational Need and Improvement: A torque sensing solution for both nonferrous metals and carbon-fiber reinforced composite shafts that does not install onto, or modify the drive shaft is needed.

Specifications Required: The goal is to deliver a non-invasive torque sensing capability that has the least possible impact on existing and next generation equipment designs, while also enabling practical upgrades to existing platforms to meet expanding mission requirements. The sensor will measure torque up to a minimum of 2kHz with recorded data rates exceeding a minimum of 5kHz.

Technology Developed: Torque and Torsional Vibration Sensor (TVS) is an all-optical sensor that measures torque and torsional vibration on rotating equipment drive trains, including shafts and couplings. TVS can be used to validate new equipment designs during development, diagnose in-service performance and vibration problems, or continuously monitor equipment health. Torsional vibration or torque spikes are difficult to detect because, prior to the TVS sensor, they required modifications to the shaft (such as an in-line torque cell or mounting of strain gauges) to diagnose or quantify. The sensor allows early detection of potential failures due to high-cycle fatigue or low-cycle over torque events.

Warfighter Value: TVS will reduce cost of ownership, improve uptime, and improve safety when operating high speed drive trains by allowing torque and torsional vibration to be continuously monitored on existing equipment without requiring redesign or requalification of the equipment. Value to the warfighter is threefold: 1) avoiding a single catastrophic shaft failure saves a multi-million dollar asset, whether it be an aircraft or a ship engine; 2) early detection of a drivetrain issue allows replacement of only the incriminated component instead of a multitude of subsystems after failure; and 3) the ability to troubleshoot torque and torsional vibration issues on any drivetrain without disassembly saves between 8 and 16 man-hours per diagnostic.

WHEN

Contract Number: N68335-18-C-0059 **Ending on:** October 1, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Validation on F/A-18 Aircraft Mounted Accessory Drive (AMAD) rig	Med	Meet target specifications	5	October 2020
Simultaneous optical probe vibration and validation on AMAD	Med	Meet target specifications	6	April 2021
Engineering data requirements agreement plan (EDRAP) for F/A-18 flight test	Low	Plan approved by Navy	6	January 2022
Validation flight testing	Low	Meet target specifications	7	July 2022

HOW

Projected Business Model: Manufacture and sell to Navy integrators, and sell direct to commercial markets.

Company Objectives: To identify aircraft and shipboard Navy applications where TVS can provide value for rotating equipment test, diagnostics or health monitoring.

Potential Commercial Applications: Industrial drive train torque measurements, health monitoring, torsional vibration diagnostics and monitoring. Potential markets include monitoring of couplings between a drive (turbine, motor) and driven equipment (compressor, pump) in power generation applications, ship drivetrains, automotive drivetrains, and oil & gas systems.

The sensor can be used as a troubleshooting and diagnostic tool to identify torque spikes and torsional vibration resonances in a vibrating drivetrain. It can also be used for permanent monitoring of an asset and detecting changes in torque over time which is an early indication of a problem in the drivetrain.

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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0375

Topic # N141-008

Multispectral six-color laser transmitter for mine hunting applications

Q Peak, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PMS 495

Transition Target: Coastal Battlefield Reconnaissance and Analysis (COBRA) Block II

TPOC:
(850)235-5404

Other transition opportunities: Airborne Laser Mine Detection System (ALMDS), Shipboard Self Defense Systems, other directed energy programs

Notes: The image at the right shows a MQ-8C Fire Scout unmanned aerial vehicle that is the intended platform for COBRA Block II.



<https://www.navair.navy.mil/product/mq-8c>

WHAT

Operational Need and Improvement: The Navy seeks to improve mine-hunting operations by using a low Size, Weight and Power (SWaP) laser source to enable detection with more wavelength diversity suitable for deployment on a Tactical Unmanned Airborne Vehicle (TUAV). This will enable mine-hunting operations to be conducted day or night and from the beach to the littoral zone.

Specifications Required: The laser source will produce four frequency bands across the visible and near infrared (NIR) with the option to change two of the wavelengths for a total of six. Two of the bands will provide vegetation sensing while a third will permit in water illumination. Significant pulse energy is required to provide a minimum system signal to noise ratio. The pulse widths will short enough to enable use in ranging systems. The target SwaP is consistent with use on a TUAV.

Technology Developed: Q-Peak has developed a compact laser pulse amplifier that enables a high-pulse-energy, one-micron laser system to be constructed. We will generate visible wavelengths by using a series of nonlinear optical elements. The wavelengths will be combined into a single beam using dichroic mirrors/polarizers. The optical elements comprising the system will be rigidly mounted using techniques compatible with high vibration environments.

Warfighter Value: The laser source that we will develop will enable enhanced detection and discrimination of mines in a variety of environments. Building the laser source consistent with use on a TUAV ensures that personnel are not exposed to hazards of close proximity mine detection. Rapid, remote mine detection, day or night from the beach to the surf will provide real time battlefield awareness

WHEN

Contract Number: N68335-20-C-0239 **Ending on:** December 20, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
One micron system complete	Med	Demonstration of pulse energy	4	December 2020
Visible and NIR wavelengths generated	Med	Demonstration of pulse energy and wavelengths	4	March 2021
Phase I Base program completed	Med	Efficient co-bore sighting of all emitted wavelengths	4	July 2021
Phase I Option complete	Med	Packaged system flight ready delivered	4	December 2022

HOW

Projected Business Model: Q-Peak's business plan would be to sell our laser source to the prime contractors who are assembling systems for the ALMDS or COBRA programs. These units will be assembled at Q-Peak's facility and if quantities exceed our capacity, we would consider licensing our technology.

Company Objectives: Our objective in participating in the Navy SBIR/STTR Transition program is to identify other applications for visible/NIR lasers. Our architecture provides flexibility in pulse energy and wavelength and may be suitable for a variety of applications. At the completion of our Phase II option, we are seeking to have our system tested in the field to further progress the TRL of our system. The technology we will develop in this program will provide a building block for future laser systems such as next generation target illumination sources.

Potential Commercial Applications: High pulse energy laser systems are typically addressed with flash-lamp pumping of laser media. The system that we will construct will offer advantages in efficiency, mean time to service, size and weight. As such, installation on aircraft platforms used in marine survey, bathymetry, search and rescue are potential commercial applications

Contact: Mr. Eric Park, Vice President and General Manager
epark@qpeak.com 781 271 1801

Space (Navy FST Booth: 3 August)



Company	Topic	Project Title
Atmospheric & Space Technology Research Associates	N16B-T026	Ocean Surface Vector Winds (OSVW)

Department of the Navy SBIR/STTR Transition Program

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NAVWAR SR-2020-210

Topic # N16B-T026

Ocean Surface Vector Winds (OSVW)

Atmospheric & Space Technology Research Associates

WHO

SYSCOM: NAVWAR

Sponsoring Program: Naval Information Warfare Center Pacific

Transition Target: The CubeSat Ocean Observing (CO2) sensor package is intended for integration on any small satellite platform, but its SWaP is ideal for use in a constellation of CubeSat buses

TPOC:

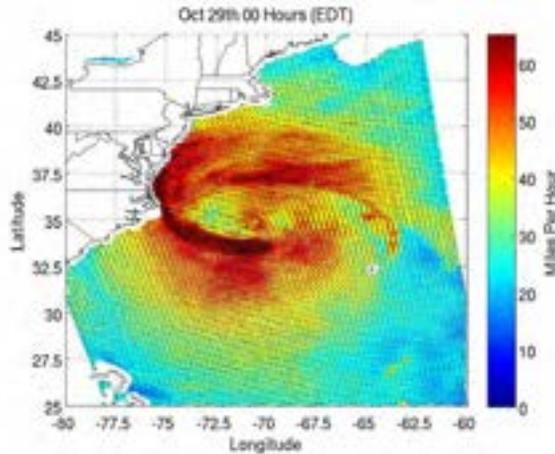
Other transition opportunities:

Currently, CO2 is scheduled for a test flight on the International Space Station (ISS). This will serve as a flight test in anticipation of manufacturing sensors for a constellation of spacecraft.

Notes: Weather forecasting, specifically Ocean Surface Vector Winds (OSVW) is critical to battlespace awareness for planning, operations and risk management for all services.

The CO2 sensor is the result of two separate successful SBIR efforts, with which ASTRA has a rich history, boasting a Commercialization Achievement Index of 90

The image above illustrates OSVW from Hurricane Sandy, and the effect storms have on sea state.



Credit NASA: Indian Space Research Organization OceanSat-2
https://www.nasa.gov/sites/default/files/images/702072main_pia16219-full.jpg

WHAT

Operational Need and Improvement: The Navy requires accurate and rapid weather forecasting for all operational theaters. WindSat, launched in 2003 as a proof on concept, must be augmented by a new generation of low Size, Weight, and Power (SWaP) sensors. The goal of this STTR is to Integrate a TRL 9 (terrestrial) low SWaP GPS reflectometry receiver for real time OSVW generation.

Specifications Required: Capability: Retrieve Ocean Surface Vector Wind speed & direction

Mass: <4.5 kg

Power: <10 W

Volume: Configuration Specific; range: 2U (20x20x20cm) - 4U**(40x40x40cm)

** This is a mission specific configuration (Phase II STTR). This payload was originally designed to occupy 2U of CubeSat volume. Mass, interface, data rate, and volume are mission configurable.

Technology Developed: A smallsat form-factor payload using the reflection of Global Positioning System (GPS) signals off the ocean to measure sea state and Ocean Surface Vector Winds (OSVW) for weather forecasting. CO2 leverages previous successful SBIR efforts that comprise the sensor package; the GPS receivers and Power Distribution Unit (PDU). We utilize commercially available hardware, as well as GPS antennas that complete the assembly.
GPS Receiver TRL: 9; PDU TRL: 8

Warfighter Value: CO2 is a novel small SWaP GPS receiver with associated signal processing algorithms to support the Navy's needs for Meteorological and Oceanographic (METOC) measurement and data collection.

These measurements are a critical input for battlespace awareness, planning, operations, and risk management for all services.

Poor conditions impact resource movements, operational ship maneuvers, evacuations, and flight operations.

Currently, the Navy's only satellite for measuring OSVW is a proof of concept spacecraft 10+ years beyond design life, with its successor scheduled to fly no earlier than 2023.

WHEN

Contract Number: N68335-19-C-0677 **Ending on:** October 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
End Phase II: Fabricate CO2 custom configuration for flight on ISS	Low	Launch payload November 2021	9	January 2021
End Phase II, Option 1: Implement retrieval algorithm onto GPS receiver	Med	Retrieve Delay Doppler Map (DDM) on-orbit		November 2021
End Phase II, Option 2: Retrieve on-orbit data; assist Navy personnel in mission operations	Low	Asses DDM data for use in operational scenarios		October 2022

HOW

Projected Business Model: ASTRA seeks to manufacture CO2 sensors for sale and integration with government and commercial small satellite buses. We can meet low-rate initial production demands while scaling for lot manufacturing. ASTRA owns the design and controls the production for all major CO2 subsystems. We will continue to work with commercial partners to lower the cost and lead time of procured, off the shelf components.

ASTRA also offers an option to provide operational service to capture data from the sensors to be distributed to subscribers. We have a state-of-the-art missions operations center currently operating multiple spacecraft on-orbit. The CO2 sensor will be a great addition to any new or existing missions that seek to fly a comprehensive earth-observing platform.

Company Objectives: While ASTRA has a rich SBIR/STTR history, we are always seeking to transition our products to the marketplace. From designing custom sensors for commercial and government missions, to operating CubeSats from our Colorado headquarters, ASTRA has a diverse set of capabilities. Our objective for this specific STTR Transition Program is to make our sensor known to service branches or companies that are currently designing or operating earth-observing spacecraft with a need for ocean weather forecasting.

Potential Commercial Applications: Providing key real-time environmental weather information, a constellation of CO2 sensors would allow constant monitoring of ocean winds, at a much lower cost to orbit than previous methods. Commercial industries, such as maritime cargo and oil shipping, could also greatly benefit from this data. Energy companies can use the information to determine where to place oil rigs and plan offshore wind farms. Marine resource managers can use the data to help prevent coastal erosion and track oil spills. International disaster preparedness, response, and recovery teams gain information that enables activation of response teams and supplies in advance of extreme events to aid recovery both for business continuity and for human welfare.

Contact: William Armijo, Deputy Director, Space Systems
warmijo@astraspace.net (303) 993-8039 x737

Weapons Technologies (Navy FST Booth: 3 August)



Company	Topic	Project Title
Infibertech, Corp.	N162-076	Miniaturization of GPS Alternative Survey Equipment
VJ Technologies Inc.	N153-132	High Energy High Flux X-ray Detector

Department of the Navy SBIR/STTR Transition Program

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MCSC-PRR-3626

Topic # N162-076

Miniaturization of GPS Alternative Survey Equipment
Infibertech, Corp.

WHO

SYSCOM: MARCOR

Sponsoring Program: IPADS

Transition Target: PM Fire Support Systems

TPOC:

sbir.admin@usmc.mil

Other transition opportunities: US Army Field Artillery and Air Defense Artillery systems

Notes:

FOG (Fiber Optic Gyro)
MCSC (Marine Corps Systems Command)
DT&E (Developmental Test & Evaluation)



Photo Courtesy USMC and Infibertech Corp.

WHAT

Operational Need and Improvement: A lighter, smaller, more flexible survey solution is required. Current IPADS (Improved Position and Azimuth Determining System) supports artillery missions by obtaining accurate Survey Control Points (SCPs) and providing accurate azimuths of lay.

Reduce the weight of the current 137 lb. IPADS to less than 30 lb. allowing a single Marine to transport and install the system while maintaining system performance.

Specifications Required: Perform survey functions over travel radius of 100 km

- Azimuth: .4 mil Probable Error (PE) 0° to 65° N/S latitude

.6 mil PE 65° to 75° N/S latitude

- Horizontal: < 4 m CEP (Circular Error Probable)

- Vertical: < 2 m PE

Technology Developed: We developed an advanced Fiber Optics Gyro (FOG) w/ lower bias and noise, larger bandwidth and increased reliability allowing for substantial SWaP savings.

FOG Reduces Inertial Navigation Unit (INU) Size: 320 in3 vs. current 1200 in3

FOG Reduces INU Weight: < 14 lbs. vs current 50 lbs.

Prototype survey system in final demonstration phase

Warfighter Value: SMALLER | LIGHTER | BETTER

The ability to execute accurate strikes at distances is critical to ground operations.

Our technology enables survey teams to register more accurate survey control points in a wider variety of conditions than the vehicle based IPADS.

The development of a new generation of lighter-weight, man-portable field artillery survey system is one of the main goals of both the Marine Corps and the Army.

Better SWaP!

WHEN

Contract Number: M67854-18-C-6519

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete Phase I	High	Successfully demonstrate simulation and modeling of gyro performance and feasibility	TRL 3	3rd QTR FY18
Complete Phase II Baseline	High	Design and implement the new Fiber Optic Gyros; Integrate Inertial sensor assembly; Test in simulated environment	TRL 5	2nd QTR FY20
Complete Phase II Option	Med	Assembly of prototype survey system; Field test in actual environment; Demonstrate survey accuracies	TRL 6	1st QTR FY21
If awarded, complete Phase II.5	Low	Complete Developmental Test & Evaluation (DT&E); transition to manufacturing; finalize auxiliary system components.	TRL 8	1st QTR FY23
If awarded, execute Phase III	Low	Enter into Phase III Contract with MCSC	TRL 8	2nd QTR FY23

HOW

Projected Business Model:

Infibertech, Corp. specialized in the development of next generation gyros based on advanced optical technologies using fiber optics and waveguide based technologies.

We are engaged in several Phase I, Phase II and Phase III programs, and developing innovative solutions for future inertial systems.

We are interested to pursue the development of specific systems (IMUs, INS) with end-users and collaboration with leading inertial manufacturers for the implementation and large scale production of such systems.

Company Objectives:

The ultimate goal of this program is to integrate the core technology into one of the Navy/Army survey systems as a long term replacement of existing platforms.

More broadly, we look for government and primes to facilitate integration into other potential applications.

Potential Commercial Applications:

Our technology enables development and deployment of next generation, smaller and lighter inertial systems for various DoD and commercial platforms: autonomous navigation for manned and unmanned aircraft, ground vehicles, ships, and submersibles. As such, it enables the capabilities of a broad range of future applications.

Contact: Ram Yahalom, President
ram1@infibertec.com (781)806-5625

Department of the Navy SBIR/STTR Transition Program

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Topic # N153-132

High Energy High Flux X-ray Detector
VJ Technologies Inc.

WHO

SYSCOM: SSP

Sponsoring Program: US Navy Strategic Systems Programs

Transition Target: Trident II D5 Fleet Ballistic Missile (FBM) Program

TPOC:

SSP.SBIR@ssp.navy.mil

Other transition opportunities:

Possible customers include Army, Navy, Air Force, NASA, large solid rocket motor industry suppliers, Department of Homeland Security, and other countries that use K15 Linatron x-ray sources to inspect rockets for their space program.

Notes: Image depicts Trident II Missile, part or all of which is inspected by HECT using the existing Linear Diode Array (LDA) detectors.



Photo courtesy of NAVSEA - <https://www.navsea.navy.mil/Home/Teams/Ships/Media-Gallery/Photo-Gallery-Copy/igphoto/2001553085/>

WHAT

Operational Need and Improvement: The current HECT system, used to inspect the D5 Trident II rocket motors, is an old design using outdated technology. As such, it has become expensive to maintain and support. The intention of this effort is to develop a new x-ray detector that is improved for performance (based on bit depth and resolution) and supportability (based on ability to procure and maintain hardware), using modern electronics, components, and interfaces. This is a difficult problem as the radiation environment is both high energy and high flux. Radiation hardening impacts detector performance. This program will develop a new detector with modern components and materials that has equal or improved performance and is more supportable for the inspection of these rocket motors.

Specifications Required: One of the (non-Navy owned) HECT systems currently in use was updated in the early 1990s and resulted in large improvements in system performance and supportability. This demonstrates that system performance can be greatly improved in all aspects. However, the materials, technology, and design from that upgrade have been made obsolete by improvements in detector technology and electronics, which made huge leaps in capability in the 2000s. A research and development (R&D) effort is necessary to ensure that new detector technology can be modified and/or redesigned to be able to operate in our specific environment (specifically, radiation hardening).

Technology Developed: Commercially-available, off-the-shelf (CA-OTS) detector elements have been identified to replace their specialized counterparts used in multiple HECT labs using LDAs to inspect defense products. There are existing cargo and fielded border inspection markets that demand high volumes of the detector elements, assuring their availability and innovation for an indefinite amount of time. Preliminary R&D and testing has been performed on the elements to confirm their eligibility to be integrated into an existing LDA with no loss of - and potentially improved - inspection performance.

Warfighter Value: Having CA-OTS detector elements will significantly reduce replacement and inventory costs. Moreover, it will assure LDAs can continue to be maintained, thereby extending the service life of them and reducing LDA replacement costs. Lastly, the high market demand for CA-OTS detector elements will ensure continuous improvement upon them, allowing the end user to reap the benefits of cutting-edge technology, performance, and cost-savings.

WHEN

Contract Number: N00030-19-C-0239 **Ending on:** August 15, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Benchmark Current Technology and Compare Against New Technology	N/A	Acquisition of Measured Output Parameters by Current and New LDA	4	June 2019
Procure, Integrate, and Test New Components at 9 MeV	Low	Verification of Repeatability of Results Obtained in Phase I	4	January 2021
Acquire 15 MeV Data on New Components	Med	Acquisition of Measured Output Parameters by New Detector and Verification of Similar Performance as that of Current LDA	4	March 2021
Decide Target Detector Configuration and Construct Selected Prototype Detector	Low	Making an Educated, Logical, Data-Driven Decision on Final System Configuration	4	June 2021
Validate Selected Detector with 9 and 15 MeV CT Scanning	Med	Meeting all Site Acceptance Criteria Met by Current LDA	4	August 2021

HOW

Projected Business Model: Founded in 1987, VJ Technologies is a leading global provider of digital X-ray inspection solutions. We apply our radioscopic digital imaging expertise to government agencies and nondestructive testing (NDT) markets throughout the world. Our business model is to identify, test, debug, integrate, and validate another manufacturer's technology so that HECT labs with LDA detectors can easily transition themselves to newer, better technology. We will fabricate a full-scale High Energy High Flux X-ray Detector Array and transition to Navy for use in inspecting D5 Trident II rocket motors in the High-Energy Computed Tomography (HECT) inspection system in China Lake.

Company Objectives: Our short term objective is to successfully complete the Phase II portion of our project to realize the benefits revealed in Phase I. Our long term objective is to transition all HECT labs using LDA detectors to new technology, and to demonstrate our expertise in Digital Radiography Systems and Services for various Program Offices. We seek to meet with Primes and Program Offices that would benefit from an upgraded inspection system to analyze their weapon systems such as those associated with the Trident II D5 Fleet Ballistic Missile (FBM) Program.

Potential Commercial Applications: This technology would be applicable to any HECT lab using LDA detectors, particularly those with X-ray source energies of 9-15 MeV. The range of applications spans from inspection of rocket motors and components to high-density aerospace parts, weapons assemblies, munitions, and large infrastructure parts/assemblies. Engage in broader commercialization efforts to field this x-ray detector suitable for use in high energy environments.

Contact: Marco Iacono, Regional Sales Manager
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In the Navy STP, we celebrate small business transition successes as well as other achievements and milestones. For updates on Phase II technologies and engaging original content from our program, follow us online:

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