

Navy STP Technology Guide



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2021-22 Navy STP Cohort

Navy STP Projects at NAVAIR and NAVSEA FST Virtual Showcase



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acquisition professionals and technologists

**NAVAIR and NAVSEA
Forum for Small Business
Innovation Research/Small
Business Technology Transfer
Transition Virtual Showcase**

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March 23 & 24



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<https://navyfst.com/events/navair-navsea-fst-days-2022/>

Collaborate to Accelerate:

Working together to enable transition

At the NAVAIR and NAVSEA FST Virtual Showcase, the Navy STP will showcase 63 projects within the Virtual Platform

Featured SBIR/STTR Technologies at the NAVAIR and NAVSEA FST Virtual Showcase

- Advanced Electronics (3 projects)
- Air Platform (14 Projects)
- Autonomy (2 Projects)
- Battlespace Environments (1 Project)
- C41 (8 Projects)
- Cyber (2 Projects)
- Electronic Warfare (2 Projects)
- Energy and Power (4 Projects)
- Ground and Sea Platforms (6 Projects)
- Human Systems (2 Projects)
- Materials & Manufacturing Processes (7 Projects)
- Modeling and Simulation (1 Project)
- Sensors (6 Projects)
- Sustainment (5 Projects)

Company	Topic #	Project	SYSCOM
Figure, Inc. d/b/a Figure Engineering	N192-119	Collective Protection System Variable Speed Drive Expansion	NAVSEA
Physical Sciences Inc.	MDA12-T001	Mine Target Reacquisition for Next Generation Mine Neutralization Systems (Sonar SLAM)	NAVSEA
Voss Scientific, LLC	N171-085	Implementation and Demonstration of LUCS, a Live, Ultra-Compact Multispectral USPL Characterization System	ONR

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NAVSEA #2021-0434

Topic # N192-119

Collective Protection System Variable Speed Drive Expansion

Figure, Inc. d/b/a Figure Engineering

WHO

SYSCOM: NAVSEA

Sponsoring Program: PMS 443 / PMS 317

Transition Target: LPD17 San Antonio Class

TPOC:
(540)684-7884

Other transition opportunities: DDG Flight IIA/Flight III, DDG 1000, LSD, LHD, LHA, Fixed Sites, Coast Guard, and military ground vehicles are all excellent candidates for a modernized Collective Protection System (CPS) implementation. Focus will be on Navy ships initially with rollout to other formats to follow.

Notes: LPD 17 class ships are a primary target due to high maintenance demands of CPS on this class ship, and would benefit most from the operational advantages of a modernized CPS.



Image courtesy of U.S. Navy

WHAT

Operational Need and Improvement: The U.S. Navy needs to modernize shipboard systems to improve usability, prolong their lifecycles, and understand maintenance intervals. In particular, Collective Protection Systems (CPS) which are critical to preventing chemical, biological, and radiological (CBR) threats employ legacy ventilation control methods. Legacy systems require significant energy consumption and travel throughout the vessel to different machinery or filter rooms to monitor the health of CPS and ensure proper functionality. In an effort to prolong system life and reduce the workload on Damage Control (DC) personnel, a modernized ventilation system with programmable control and data collection will facilitate effective monitoring and control of the system from Central Command Station (CCS).

Specifications Required: For a modernized CPS to meet the Navy's needs it must reduce installation cost, improve operational efficiency, maintain or improve warfighter safety, and reduce lifecycle/maintenance costs. Any shipboard system must meet shock, vibration, and electromagnetic interference (EMI) requirements as well as minimize size and weight to meet critical to ship functionality. While autonomous systems are ideal to improve operational efficiency, this initial system design will be semi-autonomous to provide centralized control and monitoring. However, with a modern programmable logic controller (PLC) based system, autonomy can be implemented in the future with simple software updates. The hardware will be future-proofed to meet the Navy's needs for decades to come.

Technology Developed: Figure Engineering is developing an advanced ventilation control system and health monitoring capability to promote a simplified user-interface, improve operational efficiency, prolong system life, and reduce both up front and operating costs.

Warfighter Value: Primarily, a modernized CPS will ensure protection of the warfighter from CBR threats throughout operation. Additionally, the improved control and health monitoring features will ensure the system remains functional at all times and will notify the crew if issues arise. With a more self-sufficient monitoring system, the crew is freed from many of the tasks required by operating the legacy CPS technology to ensure availability for more complex tasks. Lastly, by improving the maintainability of CPS and prolonging the lifecycle, the Navy will save money to spend elsewhere that promotes other capabilities and resources for the warfighter.

WHEN

Contract Number: N68335-21-C-0212 **Ending on:** February 28, 2024

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop in-house single-zone prototype	Low	Test data	5	November 2021
Develop in-house two-zone prototype	Low	Test data	5	February 2022
Integrate and evaluate sensors and control at Navy Laboratory	Low	Feedback from Navy stakeholders	6	November 2022
Validate long-term operation and develop specifications package	Med	Feedback from Navy stakeholders	6	August 2023

HOW

Projected Business Model: Figure Engineering develops technologies to be licensed and implemented at scale by large engineering firms or prime contractors. Figure will maintain involvement in implementation particularly when installations require modifications to the system functionality or physical infrastructure.

Company Objectives: Figure Engineering's mission is to provide the United States Department of Defense with advanced manufacturing and maintenance technologies that reduce risk, save money, optimize efficiency, and improve the worker and warfighter's experience.

Potential Commercial Applications: Advanced CPS technology, particularly when it becomes autonomous with detection systems, will be very useful in travel environments like airports and public transit stations. Particularly with the prioritization of disease spread prevention, a modernized CPS can be integrated with a variety of detection systems that expand versatility and capability.

Contact: Alex Mazzotta, Principal Investigator
Alex@FigureInc.us (571) 250-8964 x12

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NAVSEA #2021-0467

Topic # MDA12-T001

Mine Target Reacquisition for Next Generation Mine Neutralization Systems (Sonar SLAM)

Physical Sciences Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PMS 495

Transition Target: Barracuda

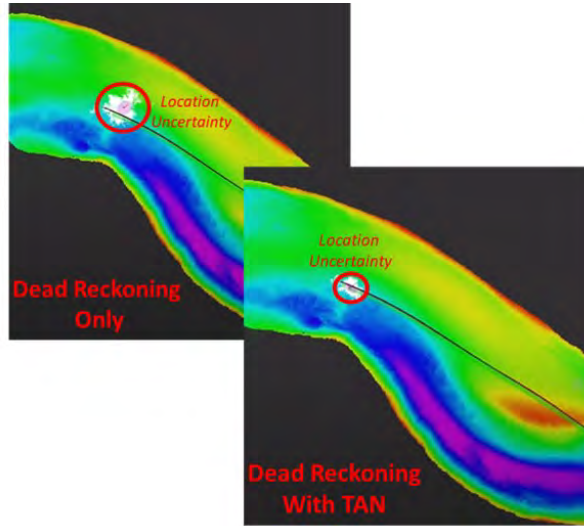
TPOC:

(850)230-7311

Other transition opportunities:

Potential applicability to PMS406 and PMS 408 UUV fleets (Swordfish, Sandshark, Kingfish, Knifefish, Razorback, Snakehead, and Orca)

Notes: Using terrain-aided navigation (TAN), sea floor features provide opportunities to constrain the location of the vehicle. These navigation resets result in bounded localization error and uncertainty as a function of mission time, marking a significant improvement over dead reckoning approaches.



Copyright 2021 [Physical Sciences Inc]

WHAT

Operational Need and Improvement: Unmanned underwater vehicles (UUV) operate in a GPS-denied environment making accurate navigation challenging. This problem is typically addressed using some form of dead reckoning based on odometry data, resulting in unbounded vehicle location error over time. Methods are needed to improve the navigation accuracy to improve mission outcomes without significantly increasing vehicle size, weight, power or cost.

Specifications Required: Size (<4 in x 2 in x 2 in), power (<10W) and cost (<\$1K) compatibility with small, expendable UUV. Real-time operation from an embedded processor to provide actionable navigation resets as the vehicle passes over sea floor features.

Technology Developed: A terrain-aided navigation (TAN) algorithm has been developed to identify the most probable vehicle path through the mission area on the basis of both dead reckoning and depth information (compared to a bathymetric map of the mission area). The resulting algorithm produces bounded vehicle location error and is computationally efficient enough for real time operation from a UUV-compatible processor. Initial demonstrations show the potential to reduce vehicle error by a margin of greater than 3x as compared to dead reckoning alone.

Warfighter Value: Enhanced navigation performance will result in improved UUV mission outcomes, including higher probability of success, reduced time to mission completion and enhanced safety for Navy personnel and assets by enabling vehicle launch from a longer standoff.

WHEN

Contract Number: N68335-19-C-0535 **Ending on:** August 18, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Simulation based TAN demonstration	Low	Reduced vehicle localization error with respect to dead reckoning in a simulation environment	3	September 2021
Data-driven TAN demonstration	Low	Reduced vehicle localization error with respect to dead reckoning using real data from Barracuda sea trials	5	August 2022
Algorithm deployment on embedded processor	Med	Real-time execution from a UUV-compatible processor	6	September 2023

HOW

Projected Business Model: PSI seeks to collaborate with undersea vehicle manufacturers/Prime Contractors to develop integrated Sonar SLAM processors for their UUV's.

Company Objectives: PSI is using the Forum for SBIR/STTR Transition (FST) event to explore new transition opportunities (e.g. PMS 406) and to assess potential applicability of the TAN algorithm in other markets (i.e. navigation of drones in GPS-denied environments). During these discussions, PSI would also want to explore opportunities for their high energy density batteries that are relevant for these platforms.

Potential Commercial Applications: The developed TAN algorithm has potential application to a wide range of UUV missions spanning mine clearing, environmental monitoring and oil pipeline survey, among others. An analogous algorithm could also be possible for the navigation of drones in GPS-denied environments using an altimeter and a terrain map. While other TAN algorithms have been developed, the particular advantage of this implementation is the reduction in computational complexity supporting real time execution with significantly reduced processor power requirements over image-based techniques.

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ONR Approval #43-8690-21

Topic # N171-085

Implementation and Demonstration of LUCS, a Live, Ultra-Compact Multispectral USPL Characterization System

Voss Scientific, LLC

WHO

SYSCOM: ONR

Sponsoring Program: PMS-405, Navy Directed Energy and Electric Weapons program office, Surface Navy Laser Weapon system (SNLWS) Program

Transition Target:

TPOC:

Quentin Sautler
quentin.sautler@navy.mil

Other transition opportunities:

USPL research and development
USPL propagation experiments
Non-linear effects and matter interaction
DOD and DOE laboratories

Notes: Sample screen from the Graphical User Interface (GUI) showing the processed Figures of Merit (FOMs) for the laser with statistics and limit bars shown.

Brass Board demonstrated in several field tests with Near Infrared (NIR), Ti:Sapphire and Short Wave Infrared (SWIR) Optical Parametric Chirped Pulse Amplification (OPCPA) lasers. The current version supports USPLs from 500 to 1700nm, including Ti:Sapphire, Yb:YAG, Erbium:Glass, and Optical Parametric Amplifier (OPA). The next generation will be extended to the Mid Wave Infrared (MWIR) 1.5-5 μm .

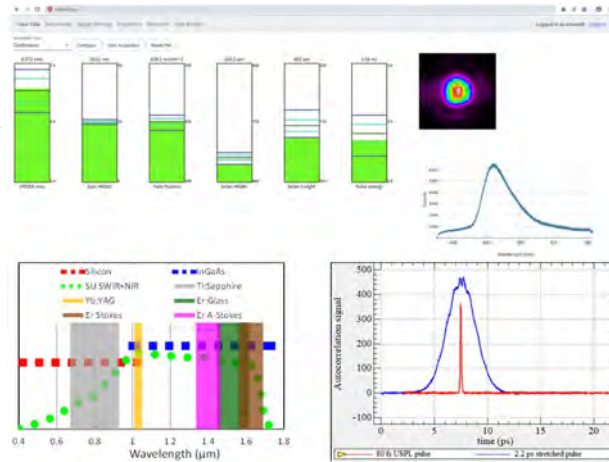


Image Courtesy of Voss Scientific, LLC

WHAT

Operational Need and Improvement: A newly developed instrument overcomes the challenge of characterization of Ultra Short Pulse Lasers (USPL).

Unlike previous systems, this new diagnostic system measures and reports a comprehensive set of USPL pulse characteristics in a live graphical display from a single, compact, detector.

The robust assembly has been tested in both laboratory and field experiments, with environments ranging from desert to maritime, and in stationary and mobile targets.

The Size Weight and Power (SWAP) requirements of the fully integrated package are small enough to allow integration into a broad range of experiments and test platforms.

The data provides a holistic picture of the laser parameters in a user-friendly Graphical User Interface (GUI) that can be viewed on any device with a web browser and network connection to the system.

Specifications Required: All critical USPL parameters are measured with high dynamic range to support variable laser settings and conditions.

- Pulse Energy: 30 dB dynamic range, adjustable scale, 500 nJ minimum
- Pulse duration: 0.06-6 picoseconds Full Width at Half Maximum (FWHM)
- Spatial profile: Adjustable depending on experiment, resolution is 1/200 of aperture
- Spectral resolution: Select-able based on spectrometer, typically 0.8 nm for NIR, 1 nm SWIR
- Data Rate: Supports lasers up to 10 kHz, image collection rate 100 Hz, GUI update 30 Hz
- Input alignment: the maximum misalignment in milliradians is 15/input aperture (mm)
- SWaP: 30 x 20 x 15 (l w h) cm, 10 kg, 50 W

Technology Developed: Live Ultra-compact Short pulse laser Characterization System (LUCS)

Warfighter Value: The ability to rapidly collect complete data for USPL experiments will advance the laser technology and provide reliable solutions to meet the needs of the war fighter, Specific applications include counter ISR, remote sensing, and electronic warfare. Commercial applications include: precision machining, high performance surface treatments, ablative surgery, etc.

WHEN

Contract Number: N68335-18-C-0303 **Ending on:** April 21, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Completed design of SWIR LUCS	N/A	Completed optical and CAD models	3	4th QTR FY18
Laboratory test of SWIR LUCS	N/A	Successful laboratory demonstration	4	3rd QTR FY20
Field test of SWIR LUCS	N/A	Successful field demonstration	6	1st QTR FY21
Completed design of MWIR LUCS	Med	Completed optical and CAD models	3	1st QTR FY22
Laboratory testing of MWIR LUCS	Med	Successful laboratory demonstration	4	2nd QTR FY22
Field testing of MWIR LUCS	High	Successful field demonstration	6	1st QTR FY23

HOW

Projected Business Model: Our goal is to manufacture and sell the LUCS system directly to government, educational, and commercial customers. We anticipate several standard configurations based primarily on the wavelength of interest and desired repetition rate; however, there will be a number of options that can be selected to customized the system for a particular application. As a small company we are highly responsive to the individual needs of each customer and will work with the scientists involved to ensure all requirements are met.

Company Objectives: Voss Scientific is seeking connections with USPL researchers who could benefit from this technology. In the short term we would like to conduct a demonstration of the MWIR LUCS in partnership with a researcher working with this type of laser. In addition, the successful demonstration of NIR and SWIR versions of the LUCS has shown that these systems are ready for use in both laboratory or field experiments.

Potential Commercial Applications: The extremely high intensities and short pulses produced by USPLs enable a wide range of applications. For example, the very short time scale of the pulse allows pump probe type experiments to follow chemical and biological process on a femtosecond time scale. The high intensity can be used to generate self focusing, broad spectral emission in materials, and Optical Parametric amplification. Increasing the intensity further and the laser can be used for extremely precise ablative machining and surface processing. These types of lasers have been used for many years in laser eye surgery due to the ability to ablate tissue with no residual heating or other damage. Future applications include laser driven accelerators capable of producing sufficient quantities of short lived Isotopes for medical use in a very compact system. One important area of research is to expand the available wavelengths of USPL systems. This requires the reliable, user friendly diagnostics the LUCS provides.

Contact: Alex Lovesee, Senior Scientist
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Company	Topic #	Project	SYSCOM
ATA Engineering, Inc	N18B-T029	Optimization of Fatigue Test Signal Compression Using The Wavelet Transform	NAVAIR
AVNIK Defense Solutions, Inc	N182-100	Data Analytics for Navy Aircraft Component Fatigue Life Management	NAVAIR
BCO Inc	N171-029	Accurate Sensing of Low Speed Vehicle Motion Relative to a Moving Platform	NAVAIR
CFD Research Corporation	N19A-T020	Data Analytics and Machine Learning Toolkit to Accelerate Materials Design and Processing Development	ONR
Continental Controls and Design, Inc.	N171-028	Lightweight Self-Start System for T56 Engine Driven Aircraft	NAVAIR
Cornerstone Research Group, Inc.	N18A-T012	Power and Propulsion System Optimization	NAVSEA
Daniel H. Wagner, Associates, Incorporated	N102-154	Intelligent Maritime Planning and execution Services (IMPS)	ONR
International Mezzo Technologies, Inc	N102-110	Cooling/Thermal Management System Development for Active Denial Technology (ADT) and High-Power Radio-Frequency vehicle Stopper (RF) Systems	NAVAIR

Air Platform Projects at NAVSEA and NAVAIR Virtual (Cont.)



Company	Topic #	Project	SYSCOM
Knowledge Based Systems, Inc.	N193-A01	EVReadi	NAVAIR
Luna Innovations Incorporated	N18A-T010	Multi-Modal Sensing of Sensitization and Stress Corrosion Cracking Susceptibility in AA5xxx Alloys	NAVSEA
SA Photonics, Inc.	N181-022	Laser Periscope Detection	NAVAIR
SAFE, Inc.	N171-026	Aircrew-Mounted Self-Adjusting Tether System	NAVAIR
Systems Technology, Inc.	NASA16-A105	Defining Handling Qualities of Unmanned Aerial Systems	NAVAIR
TDA Research, Inc.	N18A-T012	Strength Loss Indicator for Webbing	NAVAIR

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NAVAIR Public Release 2021-914

Topic # N18B-T029

Optimization of Fatigue Test Signal Compression Using The Wavelet Transform
ATA Engineering, Inc

WHO

SYSCOM: NAVAIR

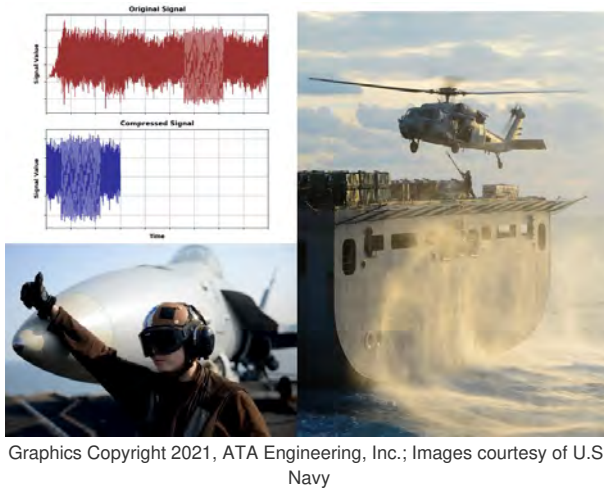
Sponsoring Program: PMA-299 H-60 Multi-Mission Helicopters

Transition Target: MH-60R and MH-60S helicopters

TPOC:
(301)342-9359

Other transition opportunities: ATA's damage squeezing technology is applicable to any defense or aerospace system that requires fatigue testing. Prime contractors developing military rotorcraft for Future Vertical Lift (FVL), such as Bell Helicopter and Sikorsky, are prospective users, as are designers of commercial aircraft and automotive components. Because fatigue is a critical concern for a broad range of defense and aerospace systems, as well as industries ranging from automotive and robotics to power generation and mineral extraction, ATA's damage squeezing technology has wide applicability.

Notes: ATA's signal editing software will fill a need for accelerated fatigue testing of aircraft subject to demanding fatigue regimes. The software will improve workflows in the design, analysis, testing, and sustainment of such vehicles and will thus be of interest to many stakeholders across the Navy and DoD.



Graphics Copyright 2021, ATA Engineering, Inc.; Images courtesy of U.S. Navy

WHAT

Operational Need and Improvement: The U.S. Navy seeks an improved signal compression methodology for generating optimally compressed fatigue test signals that, compared to the full-length signals, produce equivalent amounts of fatigue damage in predictably reduced amounts of time. ATA's damage squeezing technology offers a number of advantages over current methods, including removing arbitrary criteria and empirical guidelines and adding support for multiaxial, variable-amplitude loading of complex, dynamic structures.

Specifications Required: The Navy is targeting a less than 50% reduction in fatigue test duration for an acceptably small change in damage induced, noting that the level of achievable signal compression is highly dependent on the makeup of the original spectrum and the number of fatigue-critical locations used to constrain the signal compression process.

Technology Developed: ATA developed a systematic tool for compressing fatigue test signals that allows for faster fatigue tests without sacrificing accuracy or reliability. The methodology generates shorter-duration fatigue test signals that exhibit the same critical fatigue characteristics as the original signals, such that the accelerated tests produce field-representative failures in predictably less time. Users applying this accelerated test environment could potentially cut a year off a multi-year fatigue test program. ATA successfully demonstrated the methodology for uniaxial, quasi-static loading conditions, achieving as high as 94% signal compression with much less than 1% change in damage. The compressed signals used to conduct accelerated tests produced fatigue cracks in predictably less time compared to baseline tests—an average test time of 25 minutes (accelerated) compared to 8 hours (baseline).

Warfighter Value: As high-performance military vehicles increase in speed and maneuverability and as general economic pressures to control defense expenditures continue to grow, the need for improved fatigue life prediction and testing strategies is becoming increasingly urgent. ATA's methodology provides an efficient and reliable means for conducting accelerated fatigue tests on dynamic structures, thereby reducing the time and cost associated with full-scale fatigue testing. The wavelet-based methodology provides advantages directly to the warfighter by allowing new aircraft to be fielded more quickly, reducing downtime, and providing greater certainty of a component's fatigue life.

WHEN

Contract Number: N68335-20-C-0151 **Ending on:** January 3, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Biaxial fatigue testing with non-proportional loading	Low	>50% compression, <5% damage error, predictable cracking behavior	4	December 2021
Multiaxial fatigue testing with quasi-static loading	Med	>50% compression, <5% damage error, predictable cracking behavior	5	September 2022
Multiaxial fatigue testing with dynamic loading	Med	>50% compression, <5% damage error, predictable cracking behavior	6	November 2022
Algorithm automation and commercialization prep	Low	Removal of heuristics, IMAT™ compatible code, user guide	6	January 2023

HOW

Projected Business Model: ATA, known for delivering innovative simulation and testing solutions to DoD agencies and their contractors, plans to commercialize the outcomes of this project through two supplemental channels. The first is our engineering consulting services; ATA's core business is to provide high-value engineering consulting to our customers in the aerospace, defense, and commercial aviation industries, and we plan to equip and train our engineers with the signal editing tool so that they may apply it in solving our customers' fatigue problems. The second is algorithm licensing: because of the broad applicability of this technology, third-party engineering software and test equipment vendors are expected to have interest in incorporating the method into their products.

Company Objectives: As an advanced engineering services company, ATA is focused on providing superior and innovative analysis- and test-driven design solutions and exceptional support to our aerospace engineering clients, with frequent infusion of new analysis methods. ATA's objective in continuing development of the wavelet-based damage squeezing method is to further that mission by expanding our capabilities portfolio to provide unique benefits in this area. The signal editing technology will allow us to better support current customers including the US defense and aerospace agencies and their prime contractors, as well as those in other fatigue-critical industries.

Potential Commercial Applications: Experimental assessment of the fatigue life of critical system components is necessary in design and sustainment for a multitude of commercial applications. The damage squeezing methodology will greatly reduce the cost and schedule requirements associated with conducting full-scale and component-level fatigue testing by generating optimally compressed test signals that produce characteristic failure modes in a fraction of the time. The technology can be broadly applied to compress either quasi-static or dynamic test signals, making it a versatile tool that promises to dramatically reduce schedule and cost requirements for DoD and commercial component and airframe fatigue test programs. Successful implementation of this innovative technology will have far-reaching benefits across multiple industries, including the aerospace, defense, automotive, shipbuilding, energy, and entertainment industries.

Contact: Heather Wilkens, Ph.D., Manager, Business Development
heather.wilkens@ata-e.com 858.480.2043

Department of the Navy SBIR/STTR Transition Program

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NAVAIR

Topic # N182-100

Data Analytics for Navy Aircraft Component Fatigue Life Management
AVNIK Defense Solutions, Inc

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-276 H-1 USMC Light/Attack Helicopters

Transition Target: Decision Knowledge Programming for Logistics Analysis and Technical Evaluation (DECKPLATE), which is the next generation of Naval Aviation Logistics Data Analysis (NALDA) and will interface with Navy Enterprise Resource Planning (ERP) as the Naval Aviation Business Warehouse.

TPOC:
(301)757-3194

Other transition opportunities: Other transition opportunities include D0D Navy, Army, and Special Operations rotary-wing and tilt rotor aircraft platform PMs, to include V-22, H-60 variants, H-47 variants, Future Vertical Lift, AH-64 Apache, and potentially Unmanned Aerial Vehicle (UAV)

Notes: Utilizing the Microsoft HoloLens and augmented reality (AR), AVNIK can produce 3-D renderings (holograms) of rotorcraft, which are digital twins of platforms in the field that allows an engineer and others to walk around and explore the potential problems. AVNIK can also develop operational maintenance and maintenance training applications, using an AR headset, keeping the maintenance artisan at the point of repair and allowing them to work in a "hands-free" environment.



<https://www.marines.mil/Photos/igphoto/2000951147/igcategory/Aviation/ig>

WHAT

Operational Need and Improvement: Navy aircraft data are stored in several database management systems, both in digital format and paper records. Each of the Navy's type/model/series aircraft has its own data characteristics that depend on several factors such as (1) aircraft category (i.e., fixed or rotorcraft), (2) installed data recorders and sensors (such as the Integrated Mechanical Diagnostics System or the Vibration, Structural Life, and Engine Diagnostics System), and (3) any unique functional line duties and records that would be needed during maintenance service events (such as remove and replace, service fluids, inspection criteria, etc.).

Specifications Required: The analysis toolset needs to be: (1) able to handle structured and unstructured data; (2) able to identify and resolve data quality issues; (3) resilient to both data and processing faults; (4) quick (e.g., have a low latency retrieval of data ranging between 24-48 hours depending on criticality of alert or action needed); (5) based on modular, user-friendly, highly-customizable applications that will respond to different functional end-user needs; and (6) easily scalable. Lastly, the analysis toolset should be fully compatible with existing Navy and Marine Corps Intranet (NMCI) and logistics enterprise systems, including but not limited to relational database management systems, open source architecture, Java, Python, web compatibility (e.g., ozone widget framework), and support for Public Key Infrastructure (PKI) certificate login. The solution must meet the system DoD accreditation and certification requirements as cited in DoDI 8510.01, Risk Management Framework (RMF) for DoD Information Technology (IT), and DoDI 8500.01, Cybersecurity.

Technology Developed: Software Automated Analysis Toolset System (SAATS) is a toolset to perform prediction and flag top degrading issues with sufficient advance notice for effective root cause analysis and corrective action. Engineering, logistics, and maintenance organizations, at all levels, use these data sets as inputs to guide decision processes about engineering and sustainment planning, forecasting supply chain actions, mission planning activities, and maintenance management.

Warfighter Value: A suite of novel data analysis tools, and the integration of data mining with physics-based models, will allow maintainers to quickly assess current rotorcraft diagnostic state, make predictive life analysis, detect and address anomalies, and provide a complete traceability of part history.

WHEN

Contract Number: N68335-20-C-0316 **Ending on:** March 10, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial Architecture and Software Development Process Set	Med	Shareable workflow	4	August 2020
First Minimal Viable Product - User interface with simple Queries	Med	User successfully requests and receives information	4	March 2021
Initial Fatigue Life Management Processes and Algorithms	Low	Identify component remaining useful life (RUL)	5	September 2021
Initial Predictive Analytics	High	Provide early warning of incipient failure	5	March 2022
Maintenance Optimization	High	Provide recommended maintenance based upon RUL and early warning of incipient failure	6	September 2022
Final Prototype version	High	Demonstration	6	March 2023

HOW

Projected Business Model: AVNIK Defense Solutions, Inc., a small business specializing in programmatic, technical, and logistics management services, was formed in January 2006, is privately held and classified as a Woman Owned, Small Business (WOSB), Sub-Chapter S Corporation. We anticipate offering the SAATS technology as a Software as a Service (SaaS), where we would also provide on-going support and upgrades. Other methods of technology insertion include plugins to existing systems.

Company Objectives: We would like to meet with those who may assist with the transition and integration of the SAATS data analysis toolset into Navy and other US Military branch logistics enterprise systems to use actual flight and fleet maintenance data to validate the SAATS technology. Also, AVNIK requires assistance with validating the production system functionality for Navy/Marine rotorcraft and/or fixed wing programs of record. AVNIK would like to engage with Maintenance, Operational, and PM Engineering and Logisticians and personnel associated with various fleet readiness centers, depots, and sustainment organizations to understand their needs and requirements for maintenance optimization, commanders situational awareness, and to anticipate logisticians supply chain actions.

Potential Commercial Applications: Successful technology development would benefit the data analysis industry as a whole, providing the private sector with tools to perform quality assurance, sort, reduce, transform, display, and make projections on multiple large datasets. Potential areas that can benefit include engine manufacturers; energy production, automobile, and medical industries; and the Department of Health and Human Services.

Contact: Michele K. Platt, CEO/President
michele.platt@avnikdefense.com 256.682.6261

WHO

SYSCOM: NAVAIR

Sponsoring Program:

Transition Target:

TPOC:

301-342-5480

Other transition opportunities:

- o - DARPA's Robotic Autonomy in Complex Environments with Resiliency (RACER) program - high speed unmanned ground vehicles (UGV)

- o - Crane Aerospace is a MQ-25 subcontractor for braking control.

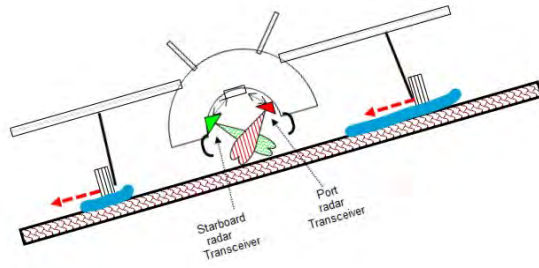
- o - Air transport operations on icy or rain-slicked taxiways for detecting sliding off taxiways.

- o - Military and civilian operation of tracked vehicles on rough/snow-covered terrain to detect sliding danger.

- o - Precision odometer for land vehicles operating GPS-denied on sand, ice, snow, and other surfaces.

- o - Military and civilian aircraft anti-skid systems to provide speed and direction of motion on taxiways when wheels are sliding laterally and little information is provided by wheel rotation counters.

- o - Military and civilian automotive anti-lock braking (ABS) and traction control systems to provide vehicle speed and direction independently of wheel rotation sensors and with no road contact.



Courtesy BCO Incorporated

WHAT

Operational Need and Improvement: Unmanned aerial vehicles(UAVs), taxiing under their own power, on the flight deck of a ship, may not move in the commanded direction. Deck surface conditions and motion of the ship could cause the aircraft to slide or skid. Knowing that the aircraft is sliding to the side can be vital to recovering from an emergency. BCO's Low Speed Sensor (LSS) enhances the ability of remotely located flight controllers to take action to counter skids/lateral sliding by making non-contact measurements of both velocity and heading in the presence of sliding/skidding from open wheel wells.

Specifications Required: A radar sensor suite based on COTS mass-produced automotive radar chips is needed which will measure both longitudinal and lateral movement referenced to a ship deck or to an asphalt runway, for speeds of 0.4 mph (7 in./sec) to 6 mph. The sensors must scan from open wheel wells. The sensors must carry out velocity measurements with moving personnel and moving equipment nearby. Microwave power levels must be safe for personnel working under the aircraft. The sensor must operate on surfaces with a wide range of radar reflectivity including: worn non-skid surfaces and fresh and salt water on the deck.

Technology Developed: BCO's Low Speed Sensor (LSS) product will utilize pairs of one axis sensors to fulfill the need for longitudinal and lateral velocity measurements. The LSS sensors use extremely economical mass produced COTS radar-system-on-a-chip technology operating in the 60-GHz unlicensed band. They operate in a swept frequency mode emitting a safe 20 mw of peak power. Breadboard one-axis sensors have been successfully tested on a moving cart on the 1/3 carrier deck at Lakehurst Naval Air Station as well as on asphalt surfaces. The radar chips house all microwave circuitry including an electronically scanned antenna array. This results in simple mass production of the sensors which are self testing. The LSS runs under BCO developed radar software.

Warfighter Value: Pilots onboard a manned aircraft maneuvering on a ship's flight deck, have visual, audible, and tactile information that is unavailable to a unmanned vehicle's remotely located flight controller. Providing vehicle velocity and heading to the remote flight controller can enable them to take timely action to counter dangerous skidding and lateral sliding.

WHEN

Contract Number: N68335-19-C-0139 **Ending on:** February 28, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Measured velocity from hand pushed carts on asphalt with COTS automotive radar chips.	N/A	Measured 0.12 mph which is well below the Navy's 0.4 mph operational range.	TRL 4	August 2017
Successful test of motorized-cart-mounted COTS chip radar at Lakehurst Naval Air Station.	N/A	Accurate measurements made of velocities over the 0.4 to 6 mph range on a carrier deck.	TRL 5	July 2021
Test of networked multiple axis sensing prototype at Lakehurst Naval Air Station	Low	Accurate measurements of velocity and heading during realistic maneuvering.	TRL 6	TBD

HOW

Projected Business Model: BCO plans to bring to market a Commercial Off the Shelf (COTS) line of standard radar sensor products. These products will be manufactured in BCO's existing low volume manufacturing facility in Billerica MA. When volume increases, BCO will turn to a network of companies offering manufacturing services, that it has dealt with over the decades. The product hardware will consist of modules based on COTS: radar and micro computer modules. The radar system will operate under proprietary radar signal analysis software developed by BCO's software group. The software (and the proprietary technology) will be licensed to the customer. Initially sales will be executive selling to potential volume customer which will integrate the sensors into their products. There are on the order of 100 firms that the executive sales team can readily identify and approach.

Company Objectives: BCO Incorporated has delivered custom-designed shipboard equipment to the Fleet for 27 years. It has built custom fielded systems for other DOD entities. It has developed radar technology capability via participation in SBIR funded radar projects for the: Navy (helicopters), Air Force (helicopters), DOT (rail vehicles), and the current UAV project for NAVAIR. BCO plans to build on its custom systems business by offering commercial-off-the-shelf (COTS) radar-sensor products. The COTS product line will be suitable for DOD programs as well as wider Government and commercial markets.

Potential Commercial Applications: o-Military and civilian air transport operations on icy or rain-slicked taxiways for detecting sliding off of taxiways.

o-Military and civilian operation of tracked vehicles on rough or snow-covered terrain to detect lateral sliding danger.

o-Military and civilian aircraft anti-skid systems to provide speed and direction of motion independent of the wheel sensors and without runway contact.

o-Military and civilian automotive anti-lock braking and traction control systems to provide vehicle speed and direction of motion independently of wheel sensors.

Department of the Navy SBIR/STTR Transition Program

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

ONR Approval #43-8832-21

Topic # N19A-T020

Data Analytics and Machine Learning Toolkit to Accelerate Materials Design and Processing Development
CFD Research Corporation

WHO

SYSCOM: ONR

Sponsoring Program: Basic Research Challenge (BRC) Program

Transition Target: PEO Aviation Common Systems and Commercial Services, PEO Tactical Aircraft Program, PEO Unmanned and Weapons

TPOC:

Dr. David Shifler
david.shifler@navy.mil

Other transition opportunities: NAVSEA, AFRL/RX, NASA GRC, NASA MSFC, DOE/NETL, DoD Primes: Lockheed Martin, GE, Boeing, Northrop Grumman



<https://www.navair.navy.mil/news/First-Navy-V-22-arrives-Patuxent-River/Wed-02052020-1141>

WHAT

Operational Need and Improvement: Navy has adopted a general strategy for enhancing the efficiency of power generation systems, such as gas turbine engines. Increased efficiency of gas turbine engines will result in increased payload capacity, higher flight speed, greater range and shorter response times

Specifications Required: Developed computational tool-kit for prediction high temperature strength and oxidation resistance for advanced alloys. Design novel alloys that meet the specification of next generation high efficiency gas turbine engines using the toolkit. Validate the design prediction against experimental results.

Technology Developed: Efficiency of the gas turbine engines are primarily limited by the development of materials for ultra-high operations and highly oxidizing environment. The technology assists in accelerating the development of such materials. Refractory High Entropy Alloy (RHEA) is a promising class of alloys for this application. Their development has been slow due to difficulty in exploring the vast compositional space. Our artificial intelligence and machine learning driven technology coupled with experimental validation provide promising results for identifying right RHEA composition from billions of possibilities that meet the target material property requirements.

Warfighter Value: Warfighters will benefit from reduced response time due increased speed and greater range of Navy aircraft. Increased payload will reduce number of sorties.

WHEN

Contract Number: N68335-20-C-0402 **Ending on:** May 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prediction of Yield Strength, Ductility and Oxidation resistance	Low	Accuracy 5-10%	3	1st QTR FY22
Identifying RHEA with Inverse Optimization	Med	Accuracy 5-10%	4	1st QTR FY22
Software Development	Low	Exact reproduction of R&D results	5	2nd QTR FY22
Validation and Verification by Customer (Real Environment)	Low	Exact reproduction of R&D Results	6	2nd QTR FY22
Transition and Deployment	High	3x reduction of development time	7	3rd QTR FY22
Fully Integrated into Program of Record	High	Material processed and deployed	8	3rd QTR FY23

HOW

Projected Business Model: CFD Research uses a Products + Services = Solutions business model where the software toolkit provides a capability that is a differentiator for scientific/engineering services. The Solutions-oriented business model allows CFD Research to offer unique value to its clients. Technical services provide insight into applications of the technology, which in turn fosters product innovation, which leads to greater value. CFD Research will work with its customers to develop new promising materials and protect IP by filing patents.

Company Objectives: CFD Research Corporation specializes in engineering simulations, advanced prototypes, and innovative designs for aerospace, defense, life sciences, materials, energy, and other industries. Using our software and experimental capabilities, we develop new hardware concepts, innovative designs, and superior solutions for our customers with lower risk, reduced costs, and less time

Potential Commercial Applications: Dual use applications could include ships, land vehicles, materials processing entities. The technology can be applied to design any materials where one needs to identify compositions that provide required material property specification. One such material is shape memory alloy which is finding applications in aerospace and auto industries. Property and performance improvement of superalloys and traditional refractory alloys can also be performed using the technology. Rational design of high-temperature coating is another application of area of this technology. Overall, this technology will find applications in commercial aerospace, auto and power generation industries.

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Department of the Navy SBIR/STTR Transition Program

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

NAVAIR 2021-848

Topic # N171-028

Lightweight Self-Start System for T56 Engine Driven Aircraft
Continental Controls and Design, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 231 E-2 Acquisition Program Office

Transition Target: E-2D Hawkeye

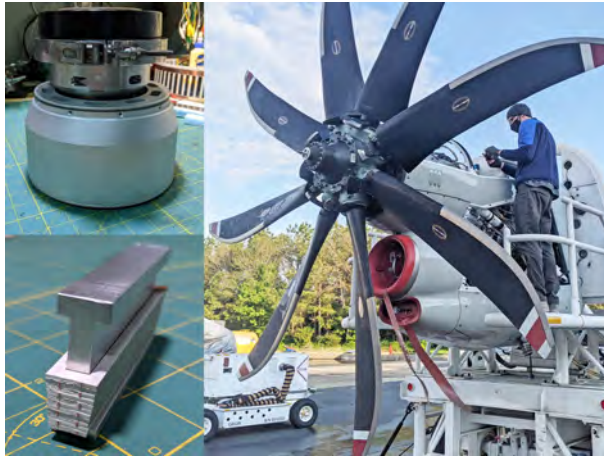
TPOC:

(301)757-2485

Other transition opportunities:

Electric drives are proliferating on aircraft and other military and commercial vehicles; some examples are vapor cycle systems, UAV and VTOL propulsion, hybrid generators. Increased power density is always beneficial in weight constrained systems.

Notes: Clockwise from upper left 1) Prototype 25lbm starter motor for 5000SHP T-56 turboshaft engine. 2) Engine on test stand at Pax River after integrating electric start components. 3) A single stator tooth showing partial patent pending 'plate' winding of nearly solid copper. Doubling the slot fill halves the electrical resistance while cutting the thermal resistance even more.



Courtesy Continental Controls and Design, 2021

WHAT

Operational Need and Improvement: The E-2D is the last carrier-launched Navy aircraft that needs ground support equipment for starting. This is both logistically expensive and operationally limiting. The conventional solution adds an onboard Auxiliary Power Unit but this would exceed the takeoff weight rating.

Specifications Required: A tight weight constraint limits the self starting weight gain to <200lbm. The current air turbine starter produces about 200NM of static torque and 30NM at 8300RPM with an outer diameter of about 8 inches and it delivers about 2MJ of energy to the single spool T-56 in 1/2 minute. An electric start system must meet these requirements over a broad range of environments to minimize turbine blade heating.

Technology Developed: The permanent magnet outer rotor uses a finely sectioned Halbach array to increase saturation flux density and patent pending formed 'plate' windings with about twice the slot fill of conventionally wound motors. The Inverter uses wide bandgap GaN switches to provide >99% efficiency.

Warfighter Value: Self starting allows streamlined carrier ops and increased access to remote airfields. Our high power density electric drive would be useful in many other military and commercial aerospace applications.

WHEN

Contract Number: N68335-18-C-0323 **Ending on:** September 30, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Trade Study and Topology Selection	Low	Feasibility Simulation	3	January 2018
Component Testing	Low	Dynamic Measurements	4	September 2019
Complete Subsystem Testing	Med	Battery Inverter, Motor Results	5	February 2020
Engine Start Test	Low	Consecutive Starts	6	April 2021
Aircraft Integration, CONOPS	Med	Environmental Testing	7	September 2022

HOW

Projected Business Model: CCD's business development team will determine the best course of action for manufacturing our EAS product with input of the original equipment manufacturer (OEM) subcontractor, which will likely involve license of manufacturing and integration rights. Prior to licensing, CCD will provide specialized services to mitigate risk and deliver confidence to our target customers. The specific manufacturing licensee depends on the program, the market, the primes, and subcontractors involved.

Company Objectives: CCD's goal is to integrate and transition this technology into government and prime contractor systems for facilitating low cost and reliable operation.

Potential Commercial Applications: Power drives are tending electric. The first application is clearly an onboard starting system but increased power density and efficiency through increased slot fill creates a larger space for electric drives. Potential military and commercial applications are vapor cycle systems, hybrid electric propulsion, starting for large and small turboshaft engines etc.

Contact: Lore Hynes, Business Administrator
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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0439

Topic # N18A-T012

Power and Propulsion System Optimization

Cornerstone Research Group, Inc.

WHO

SYSCOM: NAVSEA

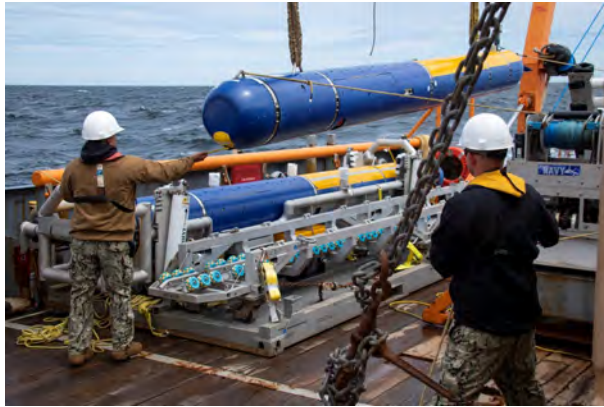
Sponsoring Program: PMS 406, Undersea Vehicles

Transition Target: Potential application is the Knifefish vehicle being used for mine detection, localization, and identification; and Large Diameter UUV, which is 48" in diameter and offers a payload capacity that lends the vehicle to multiple missions.

TPOC:
(401)832-3838

Other transition opportunities: The new propulsion system design tool will ensure scalable performance when applied to different UUVs sizes, from micro-UUVs to Large Diameter Unmanned Underwater Vehicles (LDUUVs).

Notes: CRG teamed with Battle Sight Technologies to develop and mass produce a special crayon for warfighters, first responders and disaster-relief workers. Dubbed CrayTac, this device allows troops to write messages or draw complex figures on walls, sidewalks and other surfaces. The markings are invisible except to someone wearing night-vision goggles.



<https://media.defense.gov/2019/Aug/26/2002175376-1/-1/0/190513-N-YM590-1051.JPG>

WHAT

Operational Need and Improvement: With the Navy's focus on the development and fielding of UUVs, there is a heightened need for efficient vehicle propulsion systems. These systems will allow the respective UUV to realize and achieve its maximum range, duration, and capability. As a result, energy management and efficient propulsion remains a fundamental limitation of UUVs. As more stress is placed on autonomy requiring more powerful sensors and computing, not having to compromise range and duration will necessitate the most efficient use of power for propulsion. What is performed currently to design a UUV propulsion system is a market survey and piecing together the adequate components. This methodology might provide a propulsion system for the UUV, but it is often far from optimized for the UUV's structure, mission, and size, weight, and power (SWaP) requirements.

Specifications Required: A design and analysis tool is needed that can optimize UUV power and propulsion systems for specific mission needs. This tool should be scalable across a large range of UUV size classes. It should be able to handle multiple mission objectives such as longer range or quieter systems.

Technology Developed: Cornerstone Research Group, Inc. (CRG) developed a software tool to analyze mission performance of existing UUVs and to design optimized power or propulsion component upgrades for UUVs. This software analyzes a number of UUV performance characteristics such as hydrodynamics, power generation and conversion, acoustics, and oceanographic effects. The software is modular to enable additional capabilities of interest to be incorporated as needed. It also uses multiple levels of fidelity to provide rapid results to the operator.

Warfighter Value: This technology enables improved capabilities to be provided for UUV missions. Upgraded power or propulsion systems can be retrofit to existing UUVs to increase range, to increase hotel load, or to produce quieter UUV platforms. These components can also be integrated early in the design stage for UUVs under development to further improve mission capabilities. The software can also be used to analyze existing UUVs (friendly or adversary) and predict system capabilities.

WHEN

Contract Number: N68335-20-C-0043 **Ending on:** October 28, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstration of Software Capabilities	N/A	Demonstration of software analysis and optimization capabilities	3	February 2019
Baseline UUV Demonstration	N/A	Experimental validation of performance predictions of baseline UUV	5	May 2021
Optimized UUV Demonstration	Med	Experimental validation of performance predictions of optimized UUV	5	September 2021
Open Water Test	Med	If Option awarded; higher-fidelity experimental validation of performance predictions	6	September 2022

HOW

Projected Business Model: Our business model is to provide upgraded power and propulsion components to system integrators or to end users for retrofit into existing systems or insertion into in-development platforms. An alternative use is to utilize the software to perform mission analysis of existing or in-development UUV platforms.

Company Objectives: We want to market the capabilities and uses of this technology, both on the hardware and software side, to interested parties within the Navy and primes. We want to solidify plans for transition of this technology to a Phase II Option or other follow-on opportunities to users in need of these capabilities. We anticipate that the Navy SBIR/STTR Transition Program (STP) will help facilitate connections within the Navy and prime contractors. The technology developed here is an enabler for improved UUV mission capabilities, and we see it providing value for both hardware upgrades of UUV platforms or mission analysis of UUVs.

Potential Commercial Applications: Commercial use could span to improving marketed UUVs used for oil and gas, and historical exploration. The expected deliverable from the subject effort will lead to efficient and low-noise UUVs regardless if the vehicle is used for military use or not. The UUV analysis and design software developed here was originally developed and used at CRG in relation to aircraft design and analysis. CRG sees further commercial applications for aircraft. This software could also be extended to other platforms of interest, such as unmanned surface vehicles (USVs).

Contact: Mitchell Bauer, Research Engineer
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Department of the Navy SBIR/STTR Transition Program

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

ONR Approval #43-8836-21

Topic # N102-154

Intelligent Maritime Planning and execution Services (IMPS)

Daniel H. Wagner, Associates, Incorporated

WHO

SYSCOM: ONR

Sponsoring Program: ONR

Transition Target: Maritime Tactical Command and Control (MTC2)

TPOC:

Mr. Michael Vaccaro
michael.vaccaro@navy.mil

Other transition opportunities:
Integrated Undersea Surveillance System (IUSS)

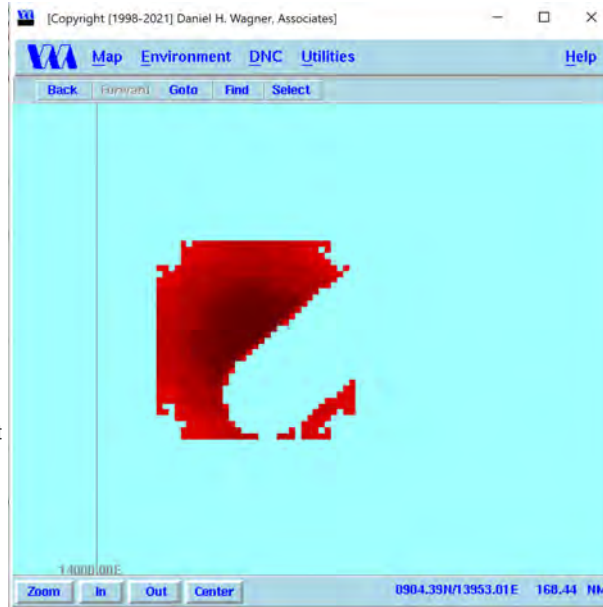
Undersea Warfare Decision Support System (USW-DSS)

PEO Sub (through APB)

SQ-89(A)V15 (through ACB)

Notes: Picture Note 1: Target of interest location including negative information from search.

Picture Note 2: Target is most likely to be located in darker red areas.



Generated by Daniel H. Wagner Associates

WHAT

Operational Need and Improvement: No systems exist that automatically estimate target location as accurately as possible, and make optimal joint use of scarce friendly undersea warfare (USW), surface warfare (SUW), and air warfare (AW) assets. IMPS automatically utilizes all available positive (sensor contact data), negative (lack of sensor contact data), and target tactics information when estimating target location, and uses multiobjective algorithms to jointly optimize the use of USW, SUW, and AW assets — a high priority for the Navy given the increasing capability of near-peer militaries. These services will enhance existing capabilities, also developed by Wagner Associates, for evaluating and optimizing asset allocation. These innovative tools are needed by the fleet and are mission critical.

Specifications Required: Need to estimate target location as accurately as possible, and make optimal use of scarce friendly undersea warfare (USW), surface warfare (SUW), and air warfare (AW) assets.

Technology Developed: IMPS provides target location estimation and mission effectiveness evaluation and optimization services, based on artificial intelligence (AI) and machine learning (ML) algorithms, that: (1) fully utilize the best available environmental data, (2) effectively support U.S. Navy undersea warfare (USW), surface warfare (SUW), and Air Warfare (AW) planners/operators, and (3) significantly improve command and control (C2), planning, and execution systems.

Warfighter Value: The expected benefits of IMPS are to: (1) increase the effectiveness of U.S. Navy undersea warfare (USW), surface warfare (SUW), and Air Warfare (AW) operations, and (2) reduce USW, SUW, and AW planner/operator time on task.

WHEN

Contract Number: N68335-21-C-0073 **Ending on:** May 13, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype IMPS Components	Low	Successful tests in Wagner lab	5	1st QTR FY22
Prototype IMPS Components Embedded in Wagner Search Planning System (WSPS)	Low	Successful tests in Wagner lab	6	3rd QTR FY22

HOW

Projected Business Model: Since 1963 Daniel H. Wagner, Associates, has provided innovative and cost-effective technical solutions to complex problems in Naval Operations Analysis and commercial/government applications, e.g.: custom resource optimization, decision support, multi-target tracking, and data fusion. Examples of successful transitions and deployments include:

- 1) Mission Optimization Configuration Item (MOCI) Web Service in Undersea Warfare Decision Support System (USW-DSS)
- 2) Acoustic Mission Planner (AMP) in MH-60R avionics system and shipboard Joint Mission Planning System (JMPS)
- 3) Computational modules for evaluating and optimizing mine countermeasures (MCM) operations and estimating risk in MINEnet Tactical
- 4) Net-Centric Data Fusion (NCDF) for USW-DSS
- 5) Data Fusion Engine (DFEN) in USW-DSS

IMPS is targeted for naval systems that could benefit from improved: (1) target location estimates incorporating both positive (sensor detections) and negative (lack of sensor detections) information, and (2) resource allocation algorithms

Company Objectives: To use our operational experience and technical skills to address challenging problems in defense analyses and provide solutions and computational components that enable warfighters to reduce their vulnerability and conduct successful and operationally effective military operations.

Potential Commercial Applications: IMPS algorithms and methodology have potential applications to border surveillance and port/facility security.

Contact: Dr. W. Reynolds Monach, President
reynolds@va.wagner.com 757-871-6284

Department of the Navy SBIR/STTR Transition Program

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

NAVAIR Public Release 2022-18

Topic # N102-110

Cooling/Thermal Management System Development for Active Denial Technology (ADT) and High-Power Radio-Frequency vehicle Stopper (RF) Systems
International Mezzo Technologies, Inc

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-275

Transition Target: V-22

TPOC:

(301) 342 - 0865

Other transition opportunities: Micro tube heat exchangers have the potential to be used many different military vehicles and aircrafts once tested and approved.

Notes: V-22 Osprey in high particulate environment



<https://www.navy.mil/Resources/Photo-Gallery/igphoto/2002742497/>

WHAT

Operational Need and Improvement: Improvement to existing heat exchanger needed to reduced fouling caused by sand and dust.

Specifications Required: Manufacture drop-in replacement micro tube heat exchanger that meets the performance requirements the current unit. Provide solution that eliminates fouling issue while maintaining current unit weight and heat transfer.

Technology Developed: In-line micro tube heat exchangers have an unsurpassed combination of low air side pressure drop, high heat transfer, ruggedness, and resistance to air side fouling. These attributes create better performance for operation in sand and dust than the current V-22 oil cooler.

Warfighter Value: V-22 will be available for more flight time due to less maintenance.

WHEN

Contract Number: N68335-18-C-0189

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Design Oil Cooler	Low	All analysis meeting qualification test standards	4	January 2021
Manufacture Drop-in Replacement Oil Cooler	Low	Completion of manufacturing	5	July 2021
Qualification Testing	Med	Pass all qualification tests with Navy	6	TBD

HOW

Projected Business Model: Mezzo would manufacture the micro tube Nacelle Heat Exchanger (NHE) for it customers. Mezzo could also provide NHE's to a system integrator.

Company Objectives: Mezzo's objective is to have the micro tube Nacelle Heat Exchanger (NHE) replace the current heat exchanger on the V-22 with the listed objectives, while upholding all of the current requirements once tested and approved.

Potential Commercial Applications: Mezzo's products are being used in high performance automotive racing, military ground vehicles, and are beginning to penetrate the aerospace market.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-904

Topic # N193-A01

EVReadi

Knowledge Based Systems, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program:

Transition Target:

TPOC:

(407)381-8936

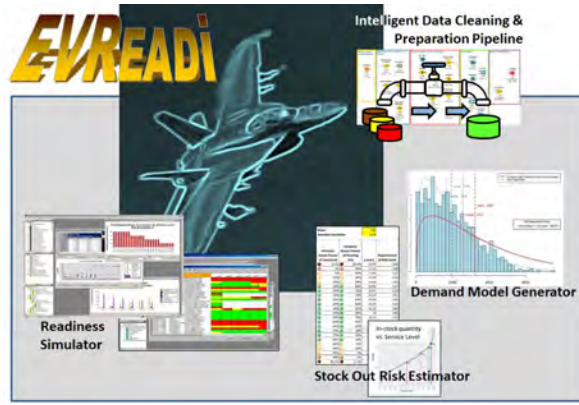
Other transition opportunities:

Operational commanders of embarked air assets (e.g., VMFA-112)

Weapons platforms - PMA-265 (F/A-18), PMA-299 (H-60)

Logistics organizations - NAVSUP Weapon System Support (WSS), Logistics Cell (LOGCELL)

Analytics organizations - CNAF Force Readiness Analytics Group (FRAG)



Timorovik Technology - Today

12

VIRIN: 201016-N-FA490-1072.JPG Photo by: Petty Officer 3rd Class Andrew Langhof

WHAT

Operational Need and Improvement: Aircraft readiness depends on an effective and efficient supply chain. It is especially important in keeping a frontline offensive supplied and ready. Doing so requires generating accurate projections of parts needs and keeping suppliers aware of current and future demands. Those forecasts are only as good as the data and models used to make those projections. Erroneous parts-related data can lead to shortages or stock outs, which decreases readiness and operational capability. The main objective of this effort is to develop innovative Artificial Intelligence (AI) and Machine Learning (ML) technologies that can predict and prescribe items for resupply.

Specifications Required: The Navy objective addressed by this topic is "Improve Readiness while reducing costs." The readiness target set by the SECDEF calls for a Mission Capability rate of 80 percent for Navy aviation. It also supports National Defense Strategy (NDS) Line of Effort, National Defense Business Operations Plan (ND BOP) Strategic Objective 1.1, and DON BOP Strategic Objective 1.1.A

Technology Developed: The EVReadi solution consists of four complementary technologies, each of which attacks a key dimension of capability involved in spare parts demand forecasting, risk-based provisioning planning, and the systematic improvement of unit readiness. They include, (i) an Intelligent Data Cleaning and Preparation Pipeline, (ii) a Machine-Learning-based Demand Model Generator, (iii) a Stock Out Risk Estimator / Visualizer, and (iv) a Readiness Simulator.

Warfighter Value: Successful development will enable the warfighter to receive the correct material at the right time and place, contributing to increased readiness and sustainment.

WHEN

Contract Number: N68335-20-F-0561 **Ending on:** June 1, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Technology Hardening	Low	Sponsor Acceptance	TRL 4	November 2021
Interim Prototype Demonstration	Low	Sponsor Acceptance	TRL 5	November 2021
Final Prototype Demonstration	Low	Sponsor Acceptance	TRL 5	March 2022
Final Report	Low	Sponsor Acceptance	N/A	April 2022

HOW

Projected Business Model: The business model options listed below were considered:

- (i) Direct sales – Customization project with training
- (ii) Technology provider - Partner with tool vendors to enhance their product (SABRE model)
- (iii) Consulting service – Keep technology in-house, use to support contract consulting (Robbins-Gioia model)

Currently, we would lean toward a combination of options i and ii.

Company Objectives: At the FST event, our objective is two-fold: First, we will be seeking a Phase II.5 sponsor and funding to accelerate prototype development, testing, demonstration, and transition activities. Second, we will seek Phase III funding/partnerships to support spare parts demand forecasting for DoD and/or commercial fleets. These activities will support the company's objective to become a technical leader recognized for accurate spare parts demand forecasting and demand-signal-based provisioning planning.

Specific programs or primes to meet include PMA-265, NAVSUP WSS, LOGCELL, CNAF FRAG, VMFA-112, SAP, companies with large aircraft fleets (e.g., FedEx, Amazon), etc.

Potential Commercial Applications: Potential commercial applications include (i) spare parts demand forecasting for aviation fleet components (e.g., FEDEX, DHL), (ii) reliability improvement project cost tradeoff analysis, and (iii) stock out risk analysis.

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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0435

Topic # N18A-T010

Multi-Modal Sensing of Sensitization and Stress Corrosion Cracking Susceptibility in

AA5xxx Alloys

Luna Innovations Incorporated

WHO

SYSCOM: NAVSEA

Sponsoring Program:

Transition Target: PMA-501 (Littoral Combat Ships), PMA-505 (LCS Fleet Introduction and Sustainment)

TPOC:
(301)227-5078

Other transition opportunities:
Technology developed under this topic may be applicable to aluminum platforms used by other services.



<https://www.navsea.navy.mil/Media/Images/igphoto/2001271115/>

WHAT

Operational Need and Improvement: High magnesium 5xxx aluminum alloys enable the Navy to build lighter, faster ships due to excellent specific strength, corrosion resistance, and as-welded strength. However, these alloys sensitize in their service environment when Mg comes out of solution to form a network of beta-phase precipitates along the grain boundaries, creating a pathway for stress corrosion cracking (SCC). Aluminum sensitization can increase the total ownership cost of a ship. The ability to predict sensitization and stress corrosion cracking onboard current and future aluminum ships is needed. Available technologies are not predictive and/or are not able to access confined spaces associated with internal structures. The Navy needs a robust SCC prediction tools for commercially available 5xxx series aluminum alloys.

Specifications Required: - Nondestructive

- Man-portable per MIL-STD-1472H

- Compact enough to fit through standard Navy watertight doors and inspect areas 12" in diameter

- Rapid results with no more than 1hr cycle time from setup to results output

Technology Developed: Luna developed a Multimodal Sensitization and SCC Analysis (M2SA) tool that provides nondestructive evaluation of current levels of sensitization and material-specific microstructural conditions for prediction of future degradation. The M2SA tool leverages rich data sets gathered through multimodal sensing as input into integrated machine learning models trained to provide actionable information about whether repair is required.

Warfighter Value: The portability, non-destructive nature, and intelligence of the M2SA system all improve upon incumbent solutions, allowing assessment of interior structures and improved prediction of future risk. Specific use cases include:

- Quality control analysis of ship construction materials will reduce future maintenance costs

- Improved damage and degradation risk assessments from shipboard inspections will improve maintenance planning for improved mission readiness

- Process optimization with feedback from the M2SA system could help material suppliers reduce production of problematic materials

WHEN

Contract Number: N68335-20-C-0322 **Ending on:** March 3, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate individual sensing modes on lab specimens	N/A	Validation of operating principles	3	December 2019
Complete portable prototype and integrated predictive algorithms	Low	Demonstrate conformance to design constraints	4	December 2021
Evaluate performance and conduct shipboard demonstration	Med	Verify device function in Navy environment	6	August 2022
Document plans for qualification and transition of technology	Low	Prepare for technology qualification	6	March 2023
Perform Reliability Assessment and Environmental Testing	Med	Demonstrated performance	8	December 2025

HOW

Projected Business Model: Luna's development of the M2SA system is a collaboration with Electrawatch LLC, a subsidiary of Austal USA and manufacturer of the incumbent DoS Probe technology. Luna intends to develop the M2SA technology and to license it to Electrawatch for sensitization assessment at repair yards.

Company Objectives: Luna's objective is to establish contact and to identify a transition pathway for the M2SA technology. Contacts of interest include those within PMA 505, PMA 500. These contacts will be critical to gaining access to representative materials for reliability assessment, for identifying specific environmental tests needed for system qualification, and for serving as the approval authority to document conformance to requirements.

Potential Commercial Applications: The ability to characterize material microstructure and to relate to material performance in service is novel and valuable to a variety of industries including the aerospace and automotive industries. In addition, use of the M2SA system by material suppliers could enable process optimization and improvement of material outcomes.

Contact: Matthew Webster, NDE Team Lead
websterm@lunainc.com (434) 220-2514

WHO

SYSCOM: NAVAIR

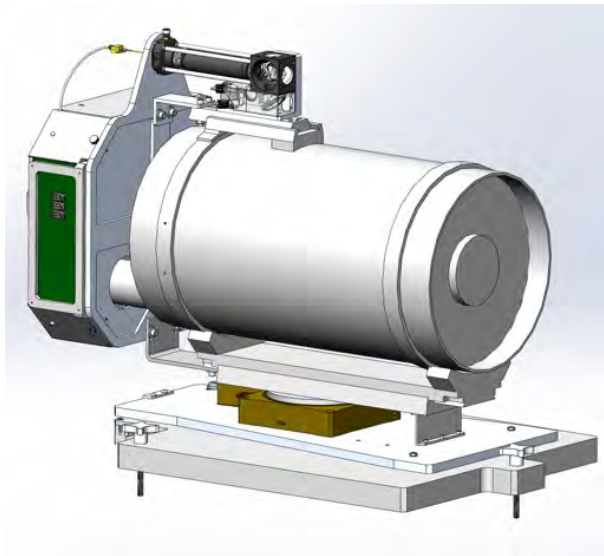
Sponsoring Program: PMA-299

Transition Target: MH-60 Helicopters

TPOC:
(301) 995-7098

Other transition opportunities: In addition to Navy Maritime Helicopters, Maritime Patrol and Reconnaissance Aircraft and U.S. Air Force integration is a possibility.

Notes: Prototype model of TRL6 HawkEye system is pictured at right.



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WHAT

Operational Need and Improvement: The need exists for improved periscope detection and better LIDAR target ID capabilities, to aid existing radar periscope / target detection. Combining data from different spectral bands increases the LIDAR probability of target detection, and reduces the probability of false alarms. A laser periscope detection system is needed that can be used with or without radar queueing, and can be integrated with existing or planned future platforms, for maximizing deployment capability.

Specifications Required: The key threshold performance objectives of the laser periscope detection are: (1) Range 8 – 22 km (post-Phase II); (2) Laser beam quality $M^2 < 2$; (3) Probability of periscope detection > 0.9 ; (4) Probability of False Alarm $1E-6$; (5) Field of Regard 360° , gimbal/pod limited.

Technology Developed: SA Photonics is developing our HawkEye™ LIDAR system to address the need of long stand-off range target detection and identification in maritime conditions. HawkEye utilizes a unique, high power yet eye-safe supercontinuum fiber laser and a multispectral detection system that enables high probability of detection, discrimination from the surface return and the ability to scan a larger region of interest. The HawkEye system is a complete LIDAR detection system with built-in beam direction control, real time data display and standardized gimbal control capabilities. HawkEye will have SWaP versions adjusted to platforms/deployment modalities, such as MH-60 and P8.

Warfighter Value: The HawkEye system will greatly improve the Warfighter ability to detect and identify maritime targets of interest at long range, facilitating defense against submarines and semi-submergibles. This will not only aid ASW missions, but improve overall warfighting / targeting capabilities of the modern fleet.

WHEN

Contract Number: N68335-20-C-0347 **Ending on:** June 16, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Critical Design Review	Low	Detailed Design Complete	4	December 2020
System Integration & Test	Low	Successful system integration of all subsystems	5	February 2022
Outdoor Test and Characterization of the System Prototype	Med	Successful testing	6	June 2022
Platform Integration / Tests	Med	Successful testing	7	June 2023

HOW

Projected Business Model: SA Photonics intends to undergo production of the HawkEye engineering model, qual and flight units of the post-Phase II payload-integrated prototypes. The company has a history of successful small-scale production for commercialized SBIR products. For larger quantity manufacturing we will work with our contract-manufacturing partner currently used for our commercial FSO system manufacturing.

Company Objectives: SA Photonics' HawkEye system is positioned to be a key enabler of Navy long-range target ID capabilities while providing a cost-saving and performance-improving ASW system to DOD. As a result, we are excited to present the product to a range of program offices at the FST, as well as a number of prime contractors, specifically those who work with MH60 and P8 platform integration.

Potential Commercial Applications: The primary application for HawkEye is with periscope detection on Navy ASW airborne platforms. However there are many secondary markets we plan to pursue, including UAVs, ISR aircraft, Search & Rescue and commercial lidar.

Department of the Navy SBIR/STTR Transition Program

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

NAVAIR 2021-849

Topic # N171-026

Aircrew-Mounted Self-Adjusting Tether System

SAFE, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: Naval Air Warfare Center Aircraft Division, Crashworthy and Escape Systems Branch

Transition Target: MV-22B

TPOC:
(301)342-3988

Other transition opportunities: CH-53K, MH-60S, UH-1Y, C-130

Notes: Image depicts a developmental prototype. Feedback from a recent user evaluation with VMX-1 at Yuma MCAS resulted in a modification to the AEV integration that will place the fairlead on the bottom of the system to simplify the system connection to aircraft floor-mounted tiedown rings. Production system will be color matched to the AEV.



Images courtesy of Safe, Inc.

WHAT

Operational Need and Improvement: Currently, mobile aircrew who serve in rotary wing platforms rely on a manually adjustable tether connected to the Aircrew Endurance Vest (AEV) or the Gunners Belt for their primary restraint system when not seated. A self-adjusting system mounted on the aircrew would allow for improved user control and functionality, increased fall protection, and enhanced safety during a potentially survivable aircraft mishap.

Specifications Required: The system must successfully restrain a mission-equipped 95th percentile male user under a 12-14g dynamic load and a drop height equal to the tether cord length. It must sustain a 5000-pound force load for a minimum of 3 seconds and a tether cord tensile strength over 8000 pounds. The system must provide automatic or manual adjustment of the tether cord slack throughout its range and allow the user to freely move about the aircraft cabin without concern for inadvertent release or twisting. The system must integrate with the CMU-37 AEV and its quick release mechanism. The system must not require modification to the aircraft or use aircraft power.

Technology Developed: The Aircrew-Mounted, Self-Adjusting Tether Systems (AMSATS) is a lightweight, self-retracting aircrew tether system with the operational controls and retraction spool mounted on the AEV providing increased mobility and safety while moving about the aircraft cabin. Innovative features include manual locking controls with auto-locking, auto-retraction, and emergency lock functionality.

Warfighter Value: This technology provides significantly improved fall and crashworthy protection to rotary wing aircrew who must move about the aircraft cabin while the aircraft is in flight.

WHEN

Contract Number: N68335-19-C-0040 **Ending on:** June 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I - Base	Low	Completed design prototype; fabricated critical structural components and completed static tests; fabricated and evaluated basic user controls	3	November 2017
Phase I - Option 1	Low	Testing, evaluation, and selection of cord material including splicing techniques	4	September 2018
Phase II - Base	Low	Fabricated functional rapid prototype & conducted initial user evaluation; Updated design & user controls; fabricated revised prototype & conducted second user eval; Completed cord fatigue testing & confirmed final cord selection; Vest integration	5	December 2019
Phase II - Option 1	Low	Updated system design based on user feedback; Conducted weight optimization; Completed vest integration including use of emergency release; Conducted third user evaluation	6	June 2021
Phase II - Option 2	Low	Refine operational features and vest integration based on user feedback; Conduct static and dynamic tests; System qualification	8	June 2022

HOW

Projected Business Model: Our business model is to design, develop, qualify, produce, and provide innovative safety systems to government and commercial customers.

Company Objectives: We anticipate the Navy SBIR/STTR Transition Program (STP) Forum will provide additional program information, interested stakeholders and contacts, guidance and recommendations that will allow us to successfully transition the Advanced Aircrew-Mounted, Self-Adjusting Tether System (AAMSATS) from development into production and full integration into the Department of Defense aviation enterprise to contribute to improve the safety and mission effectiveness of our aircrews.

Potential Commercial Applications: This technology is appropriate in additional applications where a user controlled tether-type restraint is required such as high-rise construction, bridge and building maintenance, or tower services.

Contact: Jim Schroeder, Director of Business Development
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Department of the Navy SBIR/STTR Transition Program

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

NAVAIR Public Release 2021-714

Topic # NASA16-A105

Defining Handling Qualities of Unmanned Aerial Systems
Systems Technology, Inc.

WHO

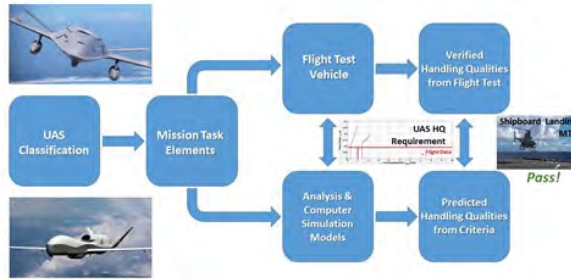
SYSCOM: NAVAIR

Sponsoring Program:

Transition Target: MQ-25 Stingray, MQ-4C Triton, MQ-8B/C Fire Scout, RQ-21 Blackjack, and MQ-9 Reaper

TPOC:
(301)757-5613

Other transition opportunities: CQ-24B K-MAX (Follow-on to CQ-24A)
MUX Medium-Altitude Long-Endurance (MALE) Demonstrator
MUX Family of Systems (FoS)
AURA Future Vertical Lift (FVL) CS3 (Optionally Piloted)
Maritime Strike FVL CS2 FoS



WHAT

Operational Need and Improvement: The burgeoning UAS arena includes traditional airframers, established UAS manufacturers, hobbyists, academic institutions, and many newcomers who see opportunity to use UAS to serve their customers in new ways. Many issues continue to slow the development of verification, validation, and certification methods for these systems. This work does not propose to tame the entire problem, but instead tackles the important need to define UAS handling qualities in piloted, pilot monitoring, and autonomous UAS operations as part of a UAS certification framework. A mission-oriented approach is applied to guide applicants and regulators considering a myriad of UAS configurations to pertinent handling qualities requirements.

Specifications Required: Designing UAS to existing manned handling qualities specs over-constrain the UAS design space

Manned aircraft specs do not apply to UAS that are an order of magnitude smaller, nor to UAS of equivalent size that no longer have to accommodate pilot comfort and control methods.

Appropriate test techniques that represent actual UAS missions and flight capabilities are needed to decrease the cost, schedule, and technical risk associated with efficient flight testing.

Supporting tools are needed to easily and repeatedly conduct analyses and simulations for UAS against design specifications and associated test maneuvers.

Technology Developed: The transitioning product is the UAS Handling Qualities Assessment software toolbox (UAS-HQ) and corresponding digital specification and test guide that will direct UAS stakeholders through a systematic evaluation process to support safe operation of UAS in increasingly complicated operating environments. The toolbox will guide users through the application of metrics that predict handling qualities and analysis of flight test data for UAS performing selected mission task elements that verify handling qualities via quantitative task performance requirements.

Warfighter Value: There is an immediate need for the UAS-HQ technology at not only NAVAIR, but also in the wider Department of Defense. For programs that have already been procured (e.g., MQ-25 Stingray, MQ-4C Triton, etc.), UAS-HQ will serve as guidance, while a verified and validated UAS-HQ will be used to support the procurement of future programs.

WHEN

Contract Number: N68335-19-C-0614 **Ending on:** August 14, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate applicability of UAS HQ analysis process to UAS	Low	Assessed approach against previously collected test data	3	December 2016
Exercise and validate complete UAS HQ process	Low	Developed and flew multiple mission task elements	5	April 2019
Create a draft specification and UAS HQ analysis toolset	Low	Review and establish baseline with technical monitor	5	April 2019
Conduct rotary wing flight test in support of draft specification	Med	Successful collection of system identification and mission task element data	6	December 2021
Tailor UAS HQ draft specification to Navy applications	Low	Successful update based on collected/analyzed test data	6	August 2022
Deliver final prototype version of UAS-HQ analysis software	Low	Updated software analysis tools and metrics based on collected/analyzed test data	6	August 2022

HOW

Projected Business Model: In this application, STI expects to generate revenue through sales of the UAS-HQ software toolbox and by providing expert consulting services on the application of the UAS handling qualities methods defined and validated in this program to the exploding UAS market. Based on our 63 year history of providing commercial consulting services to industry, STI further anticipates that productizing services around the application of UAS-HQ will ultimately lead to revenues that dwarf those generated by the software application alone.

Company Objectives: STI has for 63 years maintained a consistent position and has an established reputation in the broad areas of aircraft handling qualities, control systems design, vehicle dynamics, manual control, and system identification. This long history includes work with many unmanned systems and ongoing UAS projects that directly apply to our current business segment of expert consulting services and specialized products including analysis software such as UAS-HQ. This effort continues to enhance and build upon that established position.

This specific application supports STI's goal to productize services around SBIR-developed technologies including the UAS-HQ toolbox as a means to bring additional value to our government and commercial customers. This added value derives from our expertise built over decades in the handling qualities arena including the development and application of handling qualities requirements, standards, and specifications.

Potential Commercial Applications: UAS-HQ will be introduced to the commercial UAS markets where mission effectiveness is a significant concern (e.g., infrastructure inspections, precision agriculture, and autonomous operations within dense urban environments) to guide the assessment and verification of the mission readiness of the UAS. Further, the software plus productized service will be offered to prime military UAS contractors as a means to enhance mission effectiveness as they proceed through the design process.

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Department of the Navy SBIR/STTR Transition Program

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

NAVAIR Public Release 2021-920

Topic # N19B-T032

Strength Loss Indicator for Webbing

TDA Research, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA202
Aircraft Systems

Transition Target: PEO JSF/F-35
program

TPOC:
(760)382-7321

Other transition opportunities: Non-aircraft Naval equipment utilizing webbing; Army and Air Force aviation maintenance; Safety equipment

Notes: The image shows TDA's concept for the non-destructive determination of webbing strength utilizing magnified photos of degraded webbing. The resulting algorithm can be implemented on a cell phone, computer, or a dedicated hand held device with imaging capabilities at the point of use of the webbing. Point-of-use operation will prevent the webbing's removal from service and destructive testing, and provide cost savings over current webbing replacement schedules by providing actual strength data for determination of "use" or "replace".

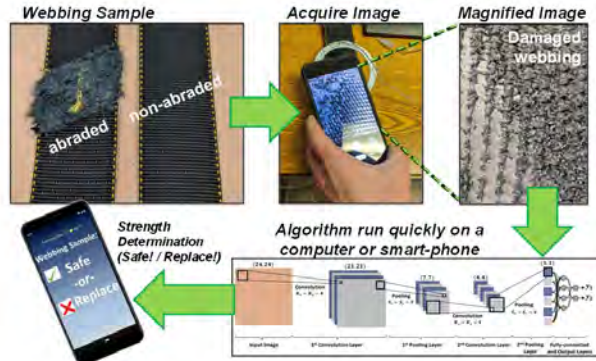


Image courtesy of TDA Research, Inc., Copyright 2021.

WHAT

Operational Need and Improvement: Due to its extensive use, the strength of the webbing is a key component of equipment design, as lives may be dependent on the strength and proper performance of the webbing. However, webbing inspection methods are limited to visual inspection. This severely limits the assessment of strength, since webbing is degraded by many unseen factors such as abrasion and UV radiation. Mechanical testing is costly and requires equipment to be taken out of use, resulting in an undesirable trade-off between costly destructive testing, premature replacement, and unnecessarily putting personnel in danger. The Navy is seeking a portable, non-destructive testing capability to detect when the strength of webbing is no longer capable of withstanding the load for which it is designed.

Specifications Required: A capability is needed to detect when the load-bearing strength of webbing has decreased into an unsafe zone. The method of webbing strength assessment should be portable for analysis at the point of use, be non-destructive and compatible with common webbing types and end-items in situ (e.g., on a restraint seat harness in an aircraft). Degradation caused by UV radiation, heat, humidity, abrasion from regular use, blowing sand or dust, and exposure to salt fog, stack gas and other chemicals, should be detectable. The ability to detect a 25% decrease in strength and elongation caused by any of these factors is desired.

Technology Developed: TDA has developed a portable, non-destructive analysis method for the inspection of webbing and determination of its mechanical properties. Using images of webbing samples obtained from a smartphone camera, webbing samples that were abraded and had tensile strengths of 20-100% of the undamaged webbing, TDA developed a predictive algorithm that determines the tensile properties of damaged webbing from the image files. With this algorithm and using a metric of 25% loss in tensile strength as a "fail", we can predict "safe" or "replace" with 95% accuracy in a "blind" test of abraded webbing samples for which tensile strength was not known prior to testing.

Warfighter Value: TDA's technology can be utilized on a computer, smartphone, or a handheld device at the point of webbing use. TDA's technology will result in cost savings over current webbing replacement schedules that require the replacement of webbing that does not need to be replaced. Webbing that needs to be replaced can be easily and quickly identified, thus providing an increased level of safety for soldiers who routinely use equipment that relies on webbing's strength to function properly.

WHEN

Contract Number: N68936-21-C-0024

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Successful Phase I performance evaluation completed by Navy	N/A	Demonstration of strength evaluation methodology	3	March 2020
Improvement of technology and hand held device design completed	N/A	Increase in method accuracy and design drawings	4	May 2021
Delivery of software/held held device to Navy at end of Phase II	High	Successful deployment of software on a computer and/or dedicated device	6-7	March 2023
Begin Phase II Option optimization of technology and device	Med	Award of gated Phase II Option	6-7	June 2023

HOW

Projected Business Model: TDA plans to commercialize this system through an internal business unit. The initial market will be DoD. Once the military has adopted the product, we expect commercial sales to follow. The product to be developed consists of a stand-alone device, or an app for a smartphone that images the webbing surface. In either case, the commercial technology here is an algorithm that is built to determine webbing mechanical properties, and that algorithm can be incorporated into any portable computing platform that can be equipped with a camera. Prior to beginning sales, TDA will need to consider the final form factor, standalone device or smartphone app, for its webbing strength indicator, though it could potentially provide both, since it is relatively inexpensive to publish and market a smartphone app. For a standalone device, TDA could manage production in our current facilities using common off-the-self (OTS) parts.

Company Objectives: TDA's goal is develop an algorithm for determining webbing strength using computational devices. Our goal is to start this business by meeting the Navy's need for a webbing strength indicator. After meeting the need for this market, TDA will first grow our technology and business to meet the demands of first responders for testing their safety equipment. Finally, and with unlimited potential, we will enter the commercial textile market for quality control of webbing and additional textiles.

Potential Commercial Applications: A commercial market for this technology will immediately exist, as the textiles market has long sought a non-destructive method for inspecting worn, fielded webbing and other textiles. Another market that would benefit from this technology is the first responder/PPE industry. Webbing is commonly used in PPE and first responder equipment (e.g., a firefighters SCBA harness). Finally, this technology could easily be adapted to analysis of other textiles (e.g., truck tie-down straps) that would benefit from regular inspection and determination of their mechanical properties once fielded. Following an initial market entry focusing on webbing, TDA could develop technology to extend to other textiles and fabrics and even expand to the clothing industry, as portable, non-destructive measurement systems for determination of textile properties could be useful in many industries for both safety and quality control applications.

Contact: Girish Srinivas, CEO
gsrinivas@tda.com 303-940-2321

Autonomy Projects at NAVSEA and NAVAIR Virtual



Company	Topic #	Project	SYSCOM
Compass Systems Inc.	N204-A01	Miniaturized End Effectors (Microelectronics)	ONR
Hy-Tek Manufacturing Co. Inc.	N192-106	Innovative Helicopter Hangar Door Seals	NAVSEA

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-8755-21

Topic # N204-A01

Miniaturized End Effectors (Microelectronics)

Compass Systems Inc.

WHO

SYSCOM: ONR

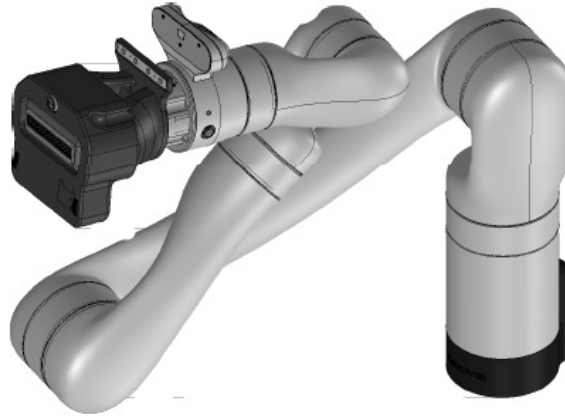
Sponsoring Program: NAVSEA
Portsmouth Naval Shipyard

Transition Target: Submarine ballast tanks

TPOC:
Corey Countryman
corey.countryman@navy.mil

Other transition opportunities: Navy and other Department of Defense storage tanks or confined spaces.

Notes: M-EEF and Robotic Arm



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WHAT

Operational Need and Improvement: The DoN has placed surface maintenance and corrosion prevention requirements as a high priority and their initiatives are geared towards fostering innovation through automated and robotic product incubation. The developmental Miniaturized-End Effector (M-EEF) will provide more effective, accurate and safer NDI solution on an automated robotic platform.

Specifications Required: The M-EEF prototype system shall demonstrate increased capability, precision, speed and efficiency that is difficult to achieve with current manual systems while creating a safer work environment by drastically reducing the need for confined space entry. The developmental M-EEF will be used to perform autonomous tasks, such as, non-destruction inspections (NDI) / metal thickness testing and corrosion detection across a wide range of water based tanks on Navy submarines and ships. Integration and miniaturization of end effectors seeking minimal change-out times.

Technology Developed: The developmental system will innovate the inspection process through automation and robotic product incubation. The Phase II M-EEF prototype will be attached to a robotic manipulator arm as an end-of arm NDI tool and integrate with current DoN Remote Operated Vehicles (ROVs) that will be used to provide inspections in small and confined space areas. By developing a miniaturized end effector inspection capability for a robotic vehicle we have enhanced the inspection process of internal tanks and provided a solution to hard to reach confined space areas. A phased array nondestructive inspection head coupled with the capacity to capture real time data has been provided to allow complex contoured surface inspections in small restricted areas.

Warfighter Value: This unique M-EEF technology will allow internal NDI tank inspections to be performed in both dry conditions, where the tanks are drained, or while in-service where the tanks remain full of water. The value of the M-EEF systems is intended. This technology provides a new capability to inspect into hard to reach confined spaces which previously might not have been accessible to the human inspector. This will significantly improve the inspection thoroughness and provide a digital record of the findings for data mining. Improvements in the maintenance and sustainment activities of ballast tanks will greatly increase.

WHEN

Contract Number: N68335-21-C-0235 **Ending on:** March 1, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
End of Phase I	Low	Demonstrated prototype successfully. Inspection detection data gathered and verified on multiple substrate materials, curved surface, wet & dry environments.	3	1st QTR FY21
Final M-EEF Prototype Design and Production	Med	This effort will provide schedule drivers, design plans, critical interfaces, bill of materials (BOM), and other manufacturing details. Design decisions, calculations, tradeoffs and Size Weight And Power (SWAP) will be finalized. This effort will transi	6	TBD
M-EEF Factory Acceptance Test	Med	This will be lab testing to evaluation of all the functional components of the M-EEF. Testing will be performed phases, Alpha and Beta testing. The testing will evaluate operational and functional aspects the M-EEF in simulated environments.	8	TBD

HOW

Projected Business Model: Compass Systems business model is primarily direct sales to the government. We have a fully capable manufacturing facility. The transition of this technology expected to be accomplished via close interaction with the Naval Undersea Warfare Center (NUWC) customer base and the ability to adapt the miniaturized end effector (M-EEF) to multiple robotic systems. The automated/smart M-EEF system will increase performance, speed and accuracy that are unattained with current manual practices. However, the business model of the robotic M-EEF is not designed to replace the current maintainer, but expand their abilities to perform current maintenance practices.

Company Objectives: We will expand the usage of our technology to address readiness and maintenance process issues facilitating agile inspection and robotic actions to augment existing capabilities. Our short-term objective is to transition the Phase II development efforts into Phase III to advance the product maturity that will enable us to provide more NDI solutions for ballast and/or water storage tanks on NAVY ships and submarines. We anticipate that the Navy SBIR/STTR transition program (STP) forum will help us make connections within other areas within the Navy (i.e. NAVAIR), other DOD groups and commercial or external industry customers. Our long-term objective will be to develop new end effector systems that can perform additional functions beyond on-board water based tanks, such as, robotic NDI solutions with fuel storage tanks.

Potential Commercial Applications: The potential big target market would be the commercial ships our product would provide NDI/NDI services for inside their on-board ballast and water storage tanks.

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Department of the Navy SBIR/STTR Transition Program

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

NAVSEA #2021-0389

Topic # N192-106

Rolling Door Seal (RDS)

Hy-Tek Manufacturing Co. Inc.

WHO

SYSCOM: NAVSEA

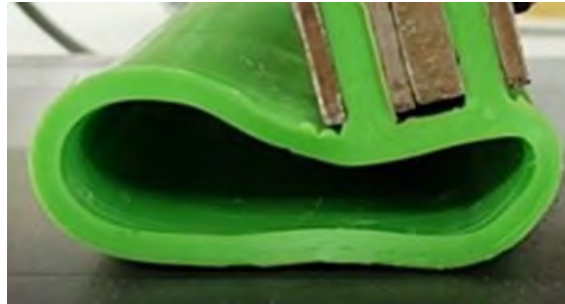
Sponsoring Program: PMS 400D, DDG 51 New Construction Program

Transition Target: DDG-51 FLT IIA/III Helicopter Hangar Doors.

TPOC:
215-897-1446

Other transition opportunities:

Various U.S. Navy marine vessel liquid seal applications as well as military and commercial systems requiring chemical resistance liquid sealing capabilities.



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WHAT

Operational Need and Improvement: HMC's Rolling Door Seal (RDS) provides Navy a departure from using "brute force" elastic deformation of a thermoplastic elastomer to form a liquid tight seal beneath the helicopter bay doors of DDG-51 Class Destroyers. RDS is comprised of a hollow elastomer boot having a geometry that allows it to roll into place beneath the helo-bay door to form a wide and reliable liquid seal without the application of unnecessary compressive or bending stresses. RDS boot structure eliminates the formation of large mechanical stresses and strain damage that occurs by acute angle deformation of the elastomer. RDS prototype testing has proven it capable of providing a reliable chemical and exposure resistance liquid seal for greater than 4800 helo-bay door cycles as well as satisfying all U.S. Navy material and performance specifications delineated in the original SBIR solicitation. These included enhanced chemical and fuel resistance, easy installation, enhanced helo-bay safety, logistics, and reduced seal replacement costs among others.

Specifications Required: • Excellent Resistance to Salt, Salt Water, Fuels such as JP-4 and JP-5, Lubricants, Hydraulic Fluids, Aqueous Film-Forming Foam (AFFF), UV Light, Chemicals and Solvents used by the U.S. Navy • Operating Temperatures: Minimum: -40°F; Maximum: 120°F • Minimum Service Life of 4800 Open/Close Cycles • Significant improvement in DDG-51 helo-bay safety logistics • Improve the operational availability of DDG-51 deployed helicopters • Significant reduction in the occurrence of seawater, fuel, or other liquid infiltration and subsequent DDG-51 component damage • Reduces Logistical Burdens Associated with DDG Helo-Bay Door Seal Installation and Maintenance • Reduces U.S. Navy's Seal Replacement Capital Costs

Technology Developed: RDS's engineered geometry practically eliminates the bending, compressive, and frictional stresses characteristic of current DDG Destroyer helo-bay door seal operation. These design features facilitate greater seal reliability and service longevity. RDS is comprised of a hollow chemical resistance elastomer boot with geometry that allows it to roll beneath the helo-bay door to form a wide and reliable liquid seal without application of excessive deformation or bending stress. Seal performance and longevity are facilitated by RDS' low material strain "roll-into-place" deformation during closure of the helo-bay door. HMC's performance analysis of mature prototypes validated that RDS facilitates an effective, repeatable, reliable, and liquid tight seal while eliminating bending and compressive stresses that cause rapid material strain failure.

Warfighter Value: RDS deployment will greatly increase DDG helo-bay door water seal performance and longevity. TRL 5 RDS prototypes have withstood protracted fuel and chemical exposure testing and 10,000 simulated door open/close cycles across artificially roughened surfaces without exhibiting

WHEN

Contract Number: N68335-21-C-0170 Ending on: January 20, 2024

Milestone	Risk Level	Measure of Success	Ending TRL	Date
RDS seal material selection	Low	Satisfy Navy Material performance specs	TRL 4	August 2021
RDS boot geometry optimization	Low	Satisfy Navy performance requirements through prototype testing	TRL 5	January 2022
RDS Extrusion Mass Fabrication	Low	Satisfy all details of RDS fabrication drawings through dimensional analysis and testing	TRL 6	January 2023
RDS Performance testing on-board DDG Destroyer helo-bay door	Med	Satisfy Navy material and performance requirements through prototype testing	TRL 7	January 2024

HOW

Projected Business Model: HMC plans to utilize its in-house manufacturing personnel and resources to directly manufacture, kit and deliver RDS and RDS variants to U.S. Navy and other clients. HMC possesses vast experience in manufacturing parts and assemblies for commercial clients including Caterpillar and AGCO as well as military clients including U.S. Navy and U.S. Army. HMC currently manufactures the High Load Roller Bearing (HLRB) for U.S. Navy DDG helicopter bay doors under a NSN and has vast experience in marketing and selling its material and mechanical innovations across multiple sectors for multiple applications. HMC plans to begin full-scale fabrication of RDS under a well-developed manufacturing plan soon after successful TRL 8 prototype performance and longevity validation testing on board a DDG destroyer. That plan will enable initial low rate RDS production within 1-month after TRL 8 validation. HMC's cost analysis validates RDS as a cost effective, reliable, and high longevity alternative to currently deployed DDG helo-bay door seals capable of generating substantial cost avoidance and positive ROI for U.S. Navy.

Company Objectives: HMC's objective for FST include technical discussions and Demonstration of the RDS technology to U.S. Navy and prime contractor stakeholders. These events will reinforce the great value that RDS brings to those stakeholders having unsatisfied marine vessel liquid sealing requirements as well as other capability gaps that can be filled through development and demonstration of application specific RDS variants. HMC will request that Navy provide introductions to prime contractors with these interests as well as help identify other Navy programs will similar capability gaps.

Potential Commercial Applications: Commercial applications for RDS include among others: Liquid seal technology for the chemical manufacturing industry, Commercial cargo vessel liquid seals, Commercial yacht builders, amphibious military vessels, Residential and commercial door, bay, and window liquid seals for coastal and flood plain regions, Marine hub seals, liquid flow channel and conduit seals.

Contact: John Jude, Engineering Director
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Company	Topic #	Project	SYSCOM
DZYNE Technologies Incorporated	SB162-009	Cloud Analytics of Satellite Imagery (CASI) for Tomahawk Mission Planning	NAVAIR

Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-901

Topic # SB162-009

Cloud Analytics of Satellite Imagery (CASI) for Tomahawk Mission Planning
DZYNE Technologies Incorporated

WHO

SYSCOM: NAVAIR

Sponsoring Program: Strike Planning & Execution Systems (PMA-281)

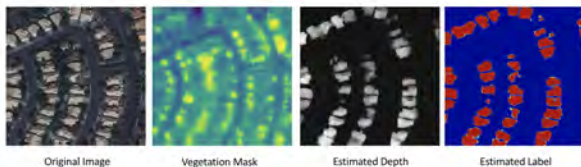
Transition Target: Theater Mission Planning Center (TMPC) system, AN/SSQ-126

TPOC:
(301)757-1884

Other transition opportunities: Other opportunities include battlespace awareness focused data set – DCGS-N, Trident missile – SSP, NGA – National Geospatial Intelligence Agency, PEO Sub – ISIS (Integrated Submarine Imaging Systems) – AN/BLQ-10. Core technologies are relevant to GPS denied navigation applications.

Notes: The Air Force Research Laboratory (AFRL) Center for Rapid Innovation (CRI) and DZYNE Technologies Incorporated resumed flight testing of the ROBOpilot unmanned air platform last year and completed a successful fourth flight test at Dugway Proving Ground, Utah, during which ROBOpilot flew for approximately 2.2 hours, completing all test objectives. ROBOpilot is an applique kit that converts a general aviation aircraft into an unmanned aerial vehicle rapidly and affordably without making any permanent modifications to the aircraft. The system can fly missions autonomously and then be removed to return the plane to its manned configuration. Installation involves removing the seats and attaching the robot to the seat rails.

CASI algorithms can perform multi-class detection against vegetation, water, roads, and depth to generate semantic label for each detection class.



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WHAT

Operational Need and Improvement: There is a compelling need for automation in the creation & validation of route navigation objects used in Tomahawk cruise missile mission planning. Assessing numerous scene areas for changes on a recurring cycle is time-consuming for a human analyst and fails to capitalize upon the dramatic increases in imagery collection, network bandwidth, and storage density over the past two decades. When coupled with the Advanced Imagery Management capabilities in development under Topic #N172-112, automated, algorithm-driven, feature-based change detection under this effort (Cloud Analytics for Satellite Imagery (CASI)) leverages both classified and unclassified commercial & public satellite imagery as well as land use classification data to assist the human analyst by flagging scene areas for prioritized review.

Specifications Required: Develop algorithmic approaches that monitor, predict, and assess selected mission-specific scene areas. Identify metrics, constraints, and performance levels needed for supporting the scene validation task, including data distribution approaches. Develop and demonstrate a limited-functionality prototype of the software system. Applications may use a single data source/type (e.g. panchromatic imagery) or a combination of sources/types (e.g. pan & multispectral imagery with topographic vector data). The prototype should focus on information collection, analysis, and product dissemination at the appropriate time scales.

Technology Developed: The CASI program will continuously and autonomously monitor scene areas as imagery is received, notifying analysts if changes in image content such as buildings, roads, vegetation and water consistently exceed threshold values. The effort will develop solutions that support (a) change detection to cultural and geographic features; (b) assessments of shadow-casters; (c) a robust notification and reporting system. Its Image Validation Service (IVS) will leverage state-of-the-art Deep Learning algorithms to detect and localize changes in newly received imagery against a stored reference (product) image.

Warfighter Value: CASI will enable the DoD to take advantage of the latest advances in AI/ML and Deep Learning to automate change detection over designated scene areas within the ISR analyst workflow. The IVS will be a modular component that can be configured to interoperate with Advanced Imagery Management or an existing collections management plan.

WHEN

Contract Number: N68335-20-C-0564 **Ending on:** June 22, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Enhance and implement detection module	Med	Routine detection of scene changes at a 50% false positive / 30% false negative threshold performance	6	December 2021
Image Validation service development	Low	Functional software release on TMPC testbed at PMA-281 Washington Planning Center (WPC) test facility	6	March 2022
Initial integration into TMPC	Med	Functional software release that is integrated into TMPC workflow	6	June 2022

HOW

Projected Business Model: DZYNE Technologies specializes in the rapid design, development, and production of advanced unmanned aircraft and analytic systems. We start from concept creation and rapid prototype development and carry it all the way through to delivery of operational systems. DZYNE Technologies has assembled a team proven in their ability not only to conceive of groundbreaking designs but also to deliver functioning systems based on those innovative designs. We house experts in many fields including aerodynamics, structural design, systems engineering, and flight test, as well as artificial intelligence, image understanding, and autonomy software. DZYNE will transition CASI into the TMPC imagery-based navigational object validation workflow and seeks other NAVAIR, Navy & DoD development opportunities related to AI/ML and Deep Learning applications. In addition, DZYNE hopes to transition CASI to multiple NGA programs for global-scale monitoring and assessment.

Company Objectives: Commercial satellite imagery combined with other intelligence can support international drug interdiction, maritime security, and treaty compliance. Further, the use of unclassified satellite imagery and data enables greater sharing of analysis products with non-DoD US agencies and coalition partners for conducting joint operations. We would like to meet with other mission planning organizations across the Services and beyond DoD who may have similar ISR & remote sensing-related workflows that might be made more efficient and less costly through the adoption of CASI capabilities that are being developed for the Navy under this effort.

Potential Commercial Applications: The commercial sector has needs in area site surveys, resource exploration, and agriculture monitoring. Information collection, analysis, and product dissemination workflows in the commercial sector may all be candidates for DoD-initiated advances such as CASI.

Contact: Paul Brewer, Director, Image Analytics
pbrewer@dzyntech.com 703-725-3084

Company	Topic #	Project	SYSCOM
4S – Silversword Software and Services, LLC	N192-082	<i>Mobile Phased Array Antenna using Through the Air Link Optical Component (TALOC) Technology</i>	NAVAIR
Carley Technologies, Inc.	N19A-T024	<i>CUES: Cyber-mediated Usable Emotional Sensors</i>	ONR
Colvin Run Networks, Inc.	N191-013	<i>Phase II: Maritime Agile Intelligent Data Exploitation Network (MAIDEN)</i>	NAVAIR
Data Fusion & Neural Networks, LLC	N193-A01	<i>Navy Artificial Intelligence Maintenance System (AIMS)</i>	NAVAIR
D-Tech, LLC	N193-A01	<i>Advanced Threat Detection and Analysis Using Multi-Dimensional ML for Industrial Control Systems (ICS)</i>	NAVAIR
DZYNE Technologies Incorporated	N172-112	<i>Smart Caching of Imagery for Carry-On System (SCICOS)</i>	NAVAIR
Intelligent Automation, Inc.	N191-034	<i>ACT: An Artificial Intelligence based Course of Action Tool</i>	NAVSEA
North Point Defense, Inc..	N193-A01	<i>WiseOwl</i>	NAVSEA

Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2022-42

Topic # N192-082

Mobile Phased Array Antenna using Through the Air Link Optical Component (TALOC)

Technology

4S - Silversword Software and Services, LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA - 265

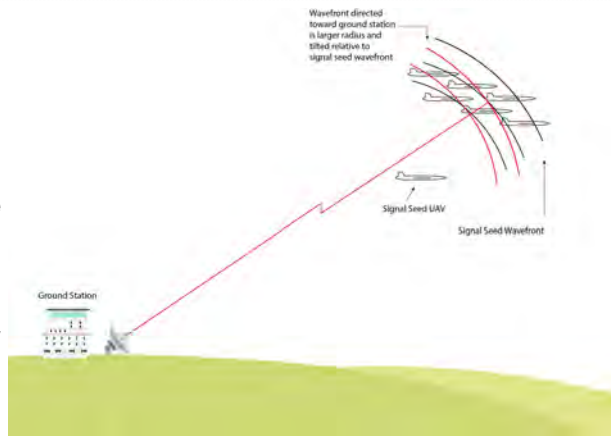
Transition Target: UAV ensembles including DARPA Gremlins

TPOC:

(301)757-6483

Other transition opportunities: Mobile Deployable Phase Array Radar, Satellite Cluster Adjustable Aperture Phase Array Antenna, Army C5ISR APNT

Notes: The graphic included in this quad chart depicts a mobile phase array antenna formed from an ensemble of UAVs to form a pinpoint communications link between the ensemble and a ground station. The black lines represent a waveform from the command unit to the ensemble. The red waveforms in the direction of the staggered line are directed toward a ground asset. This scanning and defocusing is achieved through calculations based upon the 3D map of the ensemble.



Phase Array Antenna Configuration

WHAT

Operational Need and Improvement: The solicitation requested "State-of-the-art capabilities in optical broadband communications, data fusion software, and mobile platform electro-optical acquisition and tracking to identify an expert system architecture that is near-term realizable and capable of forming an RAS mission group into a mobile phased array antenna. Design a concept for a software development roadmap encompassing expert system formation, autonomous determination of all mission group relative and absolute positions, and formation of a mobile phased array antenna. Determine minimal and optimal number of UASs necessary to form a useful phased array. Assess how an RAS mission group phased array antenna can provide operators with the ability to designate RF links among arbitrary points within the battle space." The technology developed under the Phase I and Phase II efforts addresses the needs and provides secure, mobile, high bandwidth, covert communications links between ensembles of UAVs and ground assets.

Specifications Required: The SBIR solicitation for the Phase II effort listed the following requirements. "Fabricate, test, and demonstrate a phased array antenna residing on a surrogate RAS mission group in a representative environment. Develop an expert system prototype capable of autonomous phased array antenna formation in an environment representative of field conditions such as temperatures of 20 degrees F to 150 degrees F, winds < 40 knots and altitude of 5 – 5,000 feet. Assess potential battle space capabilities and lay out a roadmap for field deployment."

Technology Developed: An optically enabled phase array antenna formed from distributed RF nodes residing on UAVs has been designed and modeled during Phase I and Phase II. This technology enables the accurate 3D mapping of mobile RF nodes for formation of a reconfigurable phase array antenna. The technology utilizes patented TALOC communications capabilities to increase positional accuracies.

Warfighter Value: The TALOC enabled mesh network constitutes an expert system with distributed processors capable of fusing all relative distance and angle measurements into a highly accurate 3D map of the overall mission group. Using the computed 3D map, the mission group is able to organize itself into a mobile phase array antenna and convey to operations center processors the information needed to designate RF links among arbitrary points within a battle space. The phase array antenna can provide operators with full range RF interconnection within the battle space.

WHEN

Contract Number: N68335-21-C-0206 **Ending on:** January 12, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
3D Map formation of antenna nodes	Low	3D Map node configuration	3	November 2017
Relative phase alignment measurement of distributed elements	Med	Required phase measurement achieved	3	September 2018
Successful dynamic element alignment maintenance	Med	Alignment accuracies achieved	4	December 2019
Evaluate beam redirection response to element phase changes	Med	Beam redirection matches theory	4	June 2021
Stage 1 demonstration	Med	Score the degree of success in performing all phase array processes identified in Task 1	5	July 2022
Stage 2 demonstration and TRL assessment	Med	TRL 6 achieved	6	TBD

HOW

Projected Business Model: Our business plan is to license the developed technology to a partner who can take the technology to full production for a program of record. We intend to identify this partner during Phase II. Once identified, we expect to enter into a close working relationship with our partner through all stages of the development.

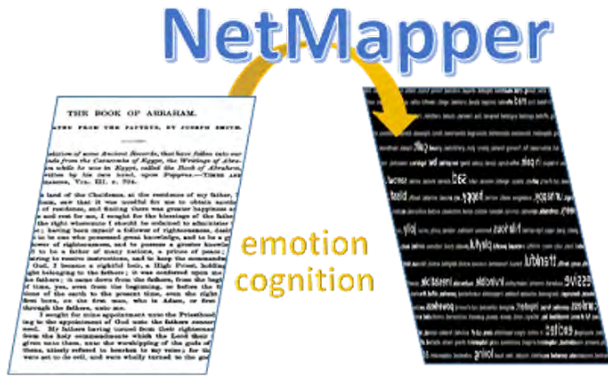
Company Objectives: 4S - Silversword is seeking Phase 2.5 funding to complete the development and testing required to successfully field the mobile phase array antenna technology developed during Phase I and Phase II. Discussions with potential partners such as Lockheed Martin and Boeing have already been initiated. We intend to bring matching funds from potential partners and programs of record to improve the funding base of the Phase 2.5 SBIR investment..

Potential Commercial Applications: Telecommunications commercial opportunities
 Low Earth Orbit (LEO) internet service is notable among emerging telecommunications initiatives. If, instead of a single RF antenna, each satellite links to a cluster of tethered RF nodes, broad band data streams may be bidirectionally directed in parallel to highly localized surface receivers. An early version of phase array narrowcast communications could be deployed in the form of aerostats or drones hovering over urban areas for 5g/6g connectivity.
 Terrain mapping commercial opportunities
 The potential value added to Side Looking Airborne Radar (SLAR) by phase array lies in the fact that SLAR cross range resolution is inversely proportional to antenna length in the direction of flight. If a phase array antenna is extended hundreds of meters by phase alignment of a linearly deployed swarm, SLAR cross range resolution becomes competitive with LIDAR while across track range is inherently well beyond the capability of LIDAR.

Contact: Ron Smith, Principal Investigator
smith@4s-llc.com 240-330-5602

WHO

SYSCOM: ONR
Sponsoring Program: Distributed Common Ground/Surface System-Marine Corps (DCGS-MC)
Transition Target: Phase III contract leading to incorporation into a Program of Record
TPOC:
 Dr. Rebecca Goolsby
rebecca.goolsby@navy.mil
Other transition opportunities:
 Distributed Common Ground/Surface System-Marine Corps (DCGS-MC);
 Distributed Common Ground System - Army (DCGS-A);
 Intelligence services in general (e.g., DIA, CIA, NSA, etc.). CyberCom;
 Law Enforcement Agencies;
 US State Department - GEC;
 DHS, other US Government Agencies;
 Insurance Companies;
 Healthcare Providers;
 Media Surveillance;
 Insider Threat Assessment;
 Threat Identification;
 Identification of at-risk Individuals;
 City and State Governments



Detecting and Labeling of Emotional Cues in Social Media Texts

WHAT

Operational Need and Improvement: Text analysis systems that uses stream analysis models and analytical tools to detect, characterize, and visualize propaganda that targets the emotions of anger, hate, fear, and disgust. The specific requirement is greatly improved ability to focus on the emotional impact of the texts on the audience. The need is for systems that go beyond the existing approaches which use dictionaries to assess whether messages are positive or negative rather than trying to assess the emotional impact on the specific audience. The needed system should operate in many languages and be easily extended to new languages. In summary, the operational need is for a system that is scalable language-agnostic open-source exploitation solutions for assessing the potential emotional impact of a message on the audience.

Specifications Required: Scalable language-agnostic open-source exploitation solution for assessing the potential emotional impact of a message on the audience should have the following properties. It must measure subconscious emotional cues in texts. It must operate in many languages, must handle multi-lingual messages and must be easily extensible to new languages. It must interpret emojis and emoticons. It must be able to efficiently process large volumes of text data in real time.

Technology Developed: Technologies developed include localized sentiment assessment algorithms, hate speech detection algorithms, and moral value assessment algorithms. The developed software is extremely efficient and offers increased speed of processing allowing real-time processing of increased volumes of messages. The developed software Interprets emojis and emoticons, operates in over 40 Languages and is easily extensible to additional languages. The developed software is also capable of operating on multi-lingual messages.

Warfighter Value: Improved situational awareness. A computational linguistic system for identifying the emotional impact of messages on the audience enables the Warfighter to better understand and predict potential audience reaction to messages by measuring the subconscious emotional cues in texts. The system offers the Warfighter improved understanding of the emotional impact of a message on the specific audience. Provides increased support for Decision Making.

WHEN

Contract Number: N68335-20-C-0568 **Ending on:** July 15, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstration of Automated Extraction of CUES from texts	Med	Successful demonstration	TRL6	3rd QTR FY21
Demonstration of Hate Speech Detector	Med	Demonstration of Detector with > 80% reliability	TRL6	4th QTR FY22
Demonstration of Moral Value Assessment	Med	Demonstration of Assessment with > 80% reliability	TRL6	4th QTR FY22

HOW

Projected Business Model: Operate as subcontractor under a Prime responsible for delivering C4I user interface. SBC delivers and supports the software developed under this contract.

Company Objectives: Incorporation of Technology into Program of Record.

Potential Commercial Applications: Healthcare
 Civil liberties advocates
 Media Surveillance;
 Insider Threat Assessment;
 Threat Identification;
 Identification of at-risk Individuals;

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NAVAIR Public Release 2021-917

Topic # N191-013

Phase II: Maritime Agile Intelligent Data Exploitation Network (MAIDEN)

Colvin Run Networks, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 290

Transition Target: PMA 290

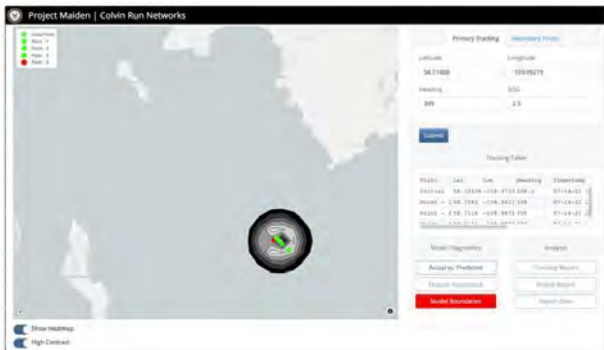
TPOC:

(301)342-2611

Other transition opportunities:

Deployable Artificial Intelligence has extensions to any platform where onboard analytics are utilized on planes, ships, or ground vehicles. We have had discussions with other NAVAIR offices, and initiatives with USAF / F-35 Joint Program Office.

Notes: P-8A operator users requested ability to modify map / visualizations on the fly per crew need. Incorporation of live data feeds from multiple sources as well as manual input was a significant user requirement.



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WHAT

Operational Need and Improvement: MAIDEN leverages established tactics and empower operators in the field with better analytics that support better decision making. Man + Machine = Better Outcome. Aircrew needs to position aircraft ahead of a subsurface contact in order to maximize tracking probability, predicting future course of contact improves sensor placement. Historical data on submarine behavior must be identified, tagged, and engineered in order to create a training set useful for predicting future action.

Specifications Required: AI software deployable to P-8A aircraft. Per customer discovery interviews, P-8A processes include time-intensive manual information supply chains with multiple analysts spending lots of time on manual data preparation and reporting. MAIDEN provides big data analytics capability to effectively manage the abundance of ingested and disparate data for the purpose of enhancing the decision-making process for maritime missions. Multi-format data streams are processed separately using a variety of tools can be augmented and integrated for analysis in the MAIDEN environment.

Technology Developed: System architecture for secure and scalable artificial intelligence model development, deployment, and data exploitation, initially tailored to P-8A program needs. The models are developed independently of the deployment - i.e. MAIDEN bridges the models available from multiple disparate intelligence sources to meet varying operator needs.

Warfighter Value: Warfighting Capability, based on User Driven Design with 20+ operators:

- Ability to reposition aircraft more efficiently
- Improve aircrew response and decision time
- Decreased sensor consumption
- Ability to rapidly reposition strategically
- Continuous threat contact improves data collection creating a virtuous cycle supporting future collection and targeting
- Decrease aircrew distraction / improve tracking
- Improve lethality of P-8 platform; shorten ISR kill chain

WHEN

Contract Number: N68335-21-C-0001 **Ending on:** November 7, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype model and interface: user driven design start	N/A	Proof-of-concept demonstration ready to iterate	3	February 2021
Anti-Submarine Warfare Third-Party (i.e. ex-PMA 290) Assessment	N/A	Identify models of potential value to P-8A operations	3	March 2021
MVP (minimal viable product) software iterative with regard to onboard data streams, sandbox adaptability, and user needs / tailoring	Low	MVP incorporating user input	4	March 2021
System Architecture	Low	Full AI deployable, scalable, secure transition plan	5	November 2021
Prototype Mature to TRL-6	Med	MAIDEN tested in a relevant environment	6	November 2022

HOW

Projected Business Model: For Navy transition, we are targeting direct contracting with Navy in a bundled software and services contract to include MAIDEN software componentry and data engineering to evolving P-8A systems & requirements. We can also license the software to contractors if needed. While this is initially a highly tailored build for the Government, the components and IP developed will have applications to many agencies and companies for deployed AI solutions.

Company Objectives: We will continue to identify avenues to deploy MAIDEN into later stage developments beyond Phase II, targeting Phase III transition to Navy Programs of Record. The Colvin Run corporate vision entails addressing the Transportation Data Management Market projected to be worth \$198.82 Billion by 2025. MAIDEN has broad deployed AI applications that are critical in the global trade and commercial shipping security, maintenance, and compliance contexts. As data and tools shift to open models, the key differentiators for companies like Colvin Run are the methods, algorithms, and user experiences in the "last mile" of advanced analytics delivery that will be furthered in the NAVAIR SBIR. Colvin Run was also identified by the US Air Force as a Top 10 Startup via MassChallenge.

Potential Commercial Applications: There is natural extension of MAIDEN to commercial enterprise since its solution components map directly to common enterprise analytics requirements:

- Data Integration & Fusion: "Ability to collect data exceeds capacity to process it." Extracting data and transferring externally with other systems, Application Programming Interfaces / API for DOD and NAVAIR / platform-specific implementation
- Data Lake: Retaining data and storing long-term for the purpose of retrieval
- Staging Environment: Preparing, Modeling, and Querying data for Business Intelligence, Analytics and Reporting using Machine Learning Methods
- Microservices: Interfacing with existing tools and systems for point of utility
- Data Governance: Normalizing and Standardizing retrieved data

Contact: John Taplett, Chief Operating Officer
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Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-916

Topic # N193-A01

Navy Artificial Intelligence Maintenance System (AIMS)

Data Fusion & Neural Networks, LLC

WHO

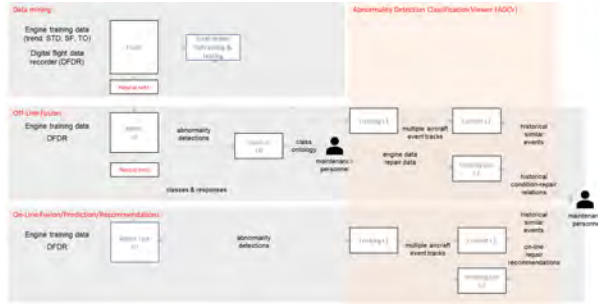
SYSCOM: NAVAIR

Sponsoring Program: PMA 265

Transition Target: KC- 130; F-18

TPOC:
(301)757-2504

Other transition opportunities: Fleet Readiness Centers (FRC)



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WHAT

Operational Need and Improvement: AIMS provides Condition-Based Maintenance (CBM) for any instrumented system. Abnormality detection neural networks (NNs) detect abnormally correlated behaviors over time and provide the abnormality signatures to the categorization NNs. The trust NNs score how similar the on-line test signature is to validation data. The valid abnormal event categorizations approved by the user will trigger repairs/responses. The new (i.e., unknown-unknowns) abnormality detection signatures will be automatically named and flagged for later user resolution.

Specifications Required: AIMS detects unknown abnormal behaviors, recognizes repair conditions, and provides recognition trust to recommend repairs. AIMS evolves with use by deciding when to retrain, what to retrain on, what to test on, and with user feedback when to promote on-line. Off-line train NNs to learn the correlated Patterns of Life behaviors in historical aviation State of Health (SOH) and detect unknown abnormal behaviors. AIMS gives default names and tracks similar abnormality detections. AIMS trains categorization and trust NNs for each abnormal signature class and finds the correlations of historical abnormal events to the overlapping repair data using Smoking Gun. The user confirms high confidence correlations of abnormal SOH events and/or pilot debriefs with recommended repairs.

Technology Developed: AIMS grows its neural architecture to be the smallest possible to meet user requirements for each data set. Smoking Gun discovers repairs correlations for user approval. Trusted repair conditions trigger repairs. AIMS gets better with use as it automatically retrains. Phase II prototyping has verified this functionality. Our goal is to transition AIMS prototype for government and commercial use.

Warfighter Value: AIMS reduces maintenance labor costs by >10% by reducing unneeded maintenance by detecting when maintenance is needed before a catastrophic fault. The savings versus preventative maintenance is measured by increase in availability. The C-130 Reliability and Maintainability Information System (REMIS) reports for the last 4 years indicate approximately 2000 repair records per tail number per year. Approximately a fourth of these are for preventative checks that would be saved by AIMS. Each record represents an average of 20 man-hours of total labor, so the savings is ~10K labor hours per year per C-130. AIMS eliminates the labor hours required to continually re-compute the engine parameter test limits and improves its performance as it is used.

WHEN

Contract Number: N68335-20-F-0590 **Ending on:** November 15, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase II AIMS Prototype TRL 4:	Low	AIMS Demonstration on C130 Data	TRL 4	November 2021
Phase II AIMS Enhancement	Med	Demonstration on Navy System Data	TRL 6	May 2023
Phase III AIMS Operationalization	Med	Demonstration on Navy Ops System	TRL 7	May 2024

HOW

Projected Business Model: Plan is to operationalize AIMS within DoD and to commercialize. The business plan is to have the user purchase AIMS (CBM) software licenses. DF&NN has TRL 7 ANOM machine learning tools that detect unknown unexpected abnormal SOH, trains on historical abnormal behaviors, automatically clusters, labels, and trains characterization NNs, and provides a characterization trust score when the NNs are applied to new operational data. We have Certification to Field (CTF) at National Space Defense Center (NSDC) and have installed at 3rd Space Experimentation Squadron (SES), 3 SOPS at Schriever AFB and installed in Thought Cloud at Kirtland AFB. We have sold licenses for our intelligent system software to Aerospace Corporation.

Company Objectives: GCPM originally developed for the C-130 using Warner Robins Digital Flight Data Recorder (DFDR), Engine Trend, Pilot Debrief, and Reliability and Maintainability Information System (REMIS) Repair Data. Phase II will affordably deliver the AIMS prototype based on the Goal-Driven Condition-Based Predictive Maintenance prototype that has been tested on five years of USAF C-130 aircraft engine, pilot debrief, and maintenance/repair data. Risk is reduced due to 40 years experience delivering machine learning systems. AIMS will be fully compliant with NIST (e.g. Zero Trust Architecture 800-207), support Cybersecurity Maturity Model Certification implementation, and be ready for installation in enclaved system architectures. We will work with our program sponsor to identify integration connections, systems, and/or databases during the Phase 2/3.

Potential Commercial Applications: The AIMS product will be sufficiently flexible through data & goal-driven processing for low cost application of nearly all instrumented (e.g. aircraft, rotorcraft, machinery, etc.) data sets and databases. AIMS will upload and synchronize individual data/databases to a cloud-based containerized AIMS instance with REST APIs that aggregates fleet-wide data. AIMS will be commercialized as part of our ANOM toolbox which will enable DoD and commercial operators and developers to have automated GCPM tools that will adapt to changing environments.

Contact: Christopher L Bowman, President
cbowman@df-nn.com 3034699828

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NAVAIR Public Release 2022-43

Topic # N193-A01

Advanced Threat Detection and Analysis Using Multi-Dimensional ML for Industrial Control Systems (ICS)

D-Tech, LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 256 (F/A-18 Program Office)

Transition Target: Navy Smart Grid (NSG), Naval Facilities Engineering Command (NAVFAC)

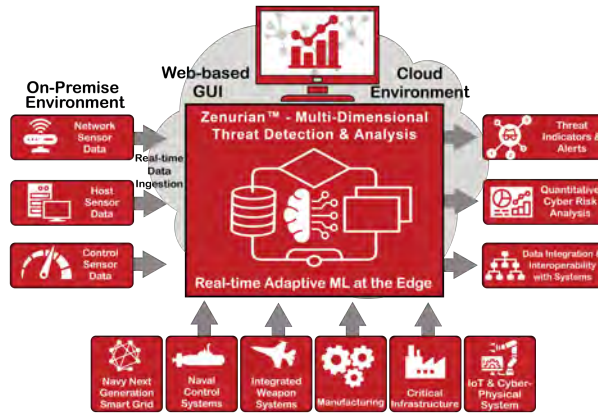
TPOC:
(301)342-3728

Other transition opportunities: DON: PEO IWS, PEO Ships, PEO UCS, NAVFAC

DOD & Other Federal Agencies: Army Digital Battlefield, SCO/FBI
Commercial Sectors: Critical Infrastructure, Manufacturing, Healthcare, Financial

Notes: Block diagram showing the Zenurian Operational View in Support of Different Programs.

Zenurian is a Multi-dimensional ML Solution for Adaptive Threat detection and Analytics in Real-Time



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WHAT

Operational Need and Improvement: DON and DOD are looking for advanced cyber threat detection techniques to secure their vast mission-critical assets and operational environments. The traditional signature-based threat discovery and intrusion detection techniques are inadequate for advanced persistent threats as the adversaries' tactics, techniques, and procedures are continuously evolving. Zenurian leverages the latest AI/Machine Learning technology to discover anomalies from multiple data sources to identify cyber threats with enhanced accuracy and performance, with little or no human intervention. Designed as a scalable and extensible web-based application, Zenurian provides cybersecurity teams and operation managers with fine-grained continuous monitoring and detection functions to achieve enhanced security management and risk-informed decision-making capabilities. It can be deployed, with minimum integration effort, in both on-premise and cloud environment, to support existing cybersecurity operations, with real-time data analytic performance and cost-effectiveness.

Specifications Required: As a software product, Zenurian is a Linux-based solution and supports a wide range of open platforms adopted by DON/DOD. It operates on commodity computing hardware. All software components are based on DOD-approved open source software. It can be deployed on premise in a single machine or in the cloud in a multi-machine cluster environment.

Technology Developed:

1. ML-driven adaptive techniques and analysis algorithms for anomaly detection and threat identification/analysis
2. Multi-dimensional data fusion and real-time stream processing
3. Extensible and customizable Web platform to support ML for cybersecurity at the edge

Warfighter Value:

1. Real-time cyber threat detection techniques with enhanced performance and reduced cost
2. Adaption to adversaries' tactics, techniques, and procedures
3. Real-time threat alerts and risk-informed decision-making for the operational team

WHEN

Contract Number: N68335-20-F-0568 **Ending on:** October 31, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete Phase II R&D with IV&V	Low	Release of Beta Product after IV&V Test	TRL 5	October 2021
Complete Product Test in a DON/DOD Lab	Med	Obtained Early Adopters and/or Beta Customers in DOD/Commercial	TRL 6	January 2022
Complete Tests in an Operational Environment	High	Identified a Prime and Completed Test for a PoR	TRL 7-8	May 2022

HOW

Projected Business Model: Since the company at this point is R&D focused, our initial strategy with focus on selling the software license and/or IPs. The key is to identify and team up a prime contractor and/or a VAR/OEM vendor as part of the technology transition strategy. In addition, we plan to work with other system integrators and technology vendors through partnerships via product integration with existing cybersecurity tools and applications. This will allow us to embed our technology within the cybersecurity technology ecosystem, and reach a broader customer base for future growth. Our short-term market strategy also includes:

1. work with prime contractors to help identify potential early adopter programs
2. obtain R&D partners to assist in further verification and validation of the technology to a wide range of applications
3. look for equity investors who understand Zenurian's potential and can help scale product development and accelerate Zenurian's growth

Company Objectives: Our long-term goal is to make D-Tech a leader in real-time ML-driven data analytics, as the ML market is expected to grow continuously in the future. Our short-term goal is to market Zenurian as an ML-at-the-edge product for real-time applications. By working with our partners and advisors, we will identify beta customers and/or early adopters in the DOD cybersecurity marketplace and bring Zenurian to operational readiness in support of different platforms. We plan to participate in various events hosted by STP and their partners, and jumpstart our marketing and outreach effort as we continue improving the product quality and meeting customers' mission requirements.

Potential Commercial Applications: In addition to cybersecurity application across multiple sectors, Zenurian can be easily extended and customized to support many commercial applications, including predictive maintenance in infrastructure and manufacturing, patient monitoring in healthcare, and fraud detection in financial applications.

Contact: Nick Duan, CTO
nduan@dtechspace.com

(703) 574-5837

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-281 (UAS) Strike Planning & Execution Systems

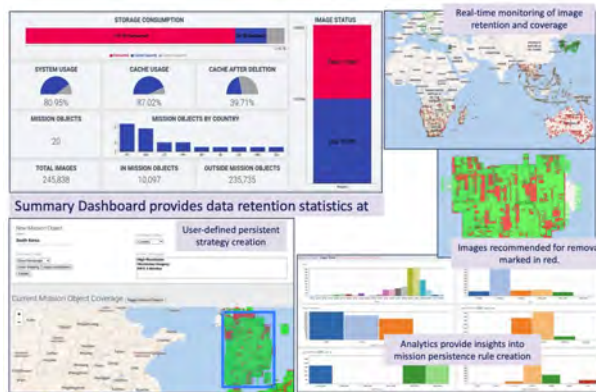
Transition Target: Theater Mission Planning Center (TMPC)

TPOC:
(301)757-1884

Other transition opportunities:

Numerous Navy/Marine Corps programs could benefit such as Distributed Common Ground System - Navy (DCGS-N) and Naval Air Warfare Center Weapons Division (NAWCWD) out of China Lake in addition to others in DoD and within the intel community.

Notes: On September 24th, 2020, AFRL and DZYNE Technologies resumed the ROBOpilot autonomous unmanned air platform's flight testing with the program's fourth flight. The test successfully accomplished all planned objectives and lasted approximately two hours. ROBOpilot is an applique kit that converts a general aviation aircraft into an unmanned aerial vehicle rapidly and affordably without making any permanent modifications to the aircraft. ROBOpilot interacts with the aircraft in the same manner as a pilot in that it "grabs" the yoke, pushes the rudders and brakes, controls the throttle, reads the dashboard gauges, etc. ROBOpilot has its own internal sensors, like GPS and an inertial measurement unit, for situational awareness. A computer analyzes all information to make decisions on how best to control the flight.



DZYNE Technologies, Copyright 2021

WHAT

Operational Need and Improvement: Currently, imagery exploitation systems that are directly connected to streaming data feeds from larger, high-capacity imagery libraries quickly fill their available storage and either fail or begin dumping imagery using some very simplistic (often First-In, First-Out) management scheme. The imagery thus held at any point represents the result of this default imagery dumping strategy than it does the intended needs of the system operator or analyst; it does not account for users query and metadata filtering priorities, which can lead to loss of valuable imagery data as onboard storage capacity becomes limited. A capability should be created that allows the system to retain more imagery over areas, and of targets that are more likely to be of immediate need, while still retaining robust, or at least some coverage, over much broader areas of potential future need.

Specifications Required: Create an open, modular imagery metadata searching and screening engine " image management algorithms, using either existing metadata tags (e.g., National Imagery Transmission Format (NITF) headers, commercial data headers, etc.) or create new metadata tags based on user inputs employing a series of filters and logical rule sets that, when applied to imagery holdings in a given system, can optimize/prioritize its data retention strategies across a given storage capacity to meet the operational needs of that particular system. Incorporate innovative user interfaces for defining the operators data retention priorities, and the graphical display of these priorities.

Technology Developed: Smart Caching of Imagery for Carry On System (SCICOS) provides a scalable imagery management system. Our data retention strategy (imagery caching) leverages the users query and persistence rules to rank imagery priority; it maintains imagery retention automatically based on users interaction and configuration of the persistence rule set, which allows the user to focus on their mission operations. SCICOS supports (a) intuitive query and filter selection of imagery by metadata; (b) an automated imagery retention based on users usage and persistence rule definition; (c) a scalable framework for imagery management that automatically extracts metadata and imagery content to increase rapid search and retrieval.

Warfighter Value: The use of imagery is essential to the Navy's maritime domain awareness. Ability to retrieve relevant imagery and retain these data sets for exploitation drastically improves the Navy's ability to conduct Intelligence Surveillance Reconnaissance (ISR) operations.

WHEN

Contract Number: N68335-19-C-0044 **Ending on:** March 31, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
SCICOS prototype demonstration at WPC against operational data	Med	SCICOS must process 250 K classified imagery per week	6	April 2023
SCICOS distribution delivered to TMPC Integration Lab for cybersecurity and unit level testing	Low	SCICOS must process 4 petabytes per month SCICOS	8	June 2023
SCICOS and TPMC testing at WPC	Med	SCICOS must process 4 petabytes per month SCICOS	8	September 2023

HOW

Projected Business Model: DZYNE Technologies specializes in the rapid design, development, and production of advanced unmanned aircraft and analytic systems. We start from concept creation and rapid prototype development and carry it all the way through to delivery of operational systems. DZYNE Technologies has assembled a team proven in their ability not only to conceive of groundbreaking designs but also to deliver functioning systems based on those innovative designs. We house experts in many fields including aerodynamics, structural design, systems engineering, and flight test, as well as artificial intelligence, image understanding, and autonomy software. DZYNE will transition this capability to the TMPC workflow and seek other transition opportunities related to GPS denied navigation applications. In addition, DZYNE is transitioning this capability to multiple NGA programs in support of global scale monitoring and assessment.

Company Objectives: We would like to meet with the Tomahawk planning organizations of other services who may have similar workflows that might be made more efficient and less costly through the adoption of CASI capabilities that are being developed for the Navy under this effort.

Potential Commercial Applications: The imagery management service framework is also currently being leveraged by our work with the Defense Threat Reduction Agency (DTRA) to support and manage parametric threat simulation analysis for Weapon of Mass Destruction deterrence. Similarly, DZYNE continues to develop our expertise in metadata and image content extraction algorithms to support the DARPA program to develop the Cloud Analytics of Satellite Imagery for global situation awareness. The commercial sector in the area site surveys, resource exploration, and agriculture monitoring. Commercial applications include system architecture and software enabling information collection, analysis, and analysis product dissemination at the appropriate time scales required for application support.

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0438

Topic # N191-034

ACT: An Artificial Intelligence based Course of Action Tool
Intelligent Automation, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS 1.0

Transition Target: Navy Weapon Systems Mission Planning Systems

TPOC:

(540)653-1240

Other transition opportunities: Navy Weapon System

Notes: ACT leverages new technologies to benefit Navy weapon systems.



ACT System OV-1

WHAT

Operational Need and Improvement: ACT as an AI-based COA solution will be a scalable, composable, timely and effective automated decision aid that will provide COA recommendations to mission planners for consideration and action.

Specifications Required: ACT is designed and developed as a software enhancement to the Navy mission planning process. The virtual assistant provided by ACT provides potential improvement over an unassisted operator (on average). The proposed effort will comply with Navy mission planning system requirements

Technology Developed: The technology developed will include:

- 1) Identify Navy operational scenarios
- 2) Represent mission planners' knowledge and experiences for COA planning and recommendation
- 3) Monitor COA progress
- 4) Support diversified data sources
- 5) Generate optimal COAs with much less labor intensity, time, and complexity.

ACT will be an integrated set of AI-enabled services that support tactical operations and mission planning and execution.

Warfighter Value: The key goals will be reducing human cognitive burden, aiding decision making, and increasing decision making accuracy. This will improve the Navy mission planning capability in a variety of combat environments.

WHEN

Contract Number: N68335-21-C-0030

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Interim subsystems demonstration	Low	Demo ACT subsystems' capabilities.	4-5	October 2021
Initial prototype system integration	Med	Demo initial integrated ACT system .	5-6	October 2022
Integrated prototype system demo for the Navy	Med	Demo integrated prototype system.	6-7	September 2023

HOW

Projected Business Model: We plan to transition the ACT technology to a Navy program of record. We can also licensing core technology to other commercial/government customers, and commercialize the software tool. We will develop and maintain ACT analytic modules, subsystems, and the system, to make them available for other tactical and commercial applications through contract engineering and licensing agreements.

Company Objectives: We plan to develop and license the technology to prime contractors and/or transition it to government programs. We will identify DoD mission planning system stakeholders for opportunities of additional ACT system evaluation and integration.

Potential Commercial Applications: ACT has the potential to address commercial market needs that require applications in the areas of intelligent process, automation, and AI. ACT has potential to market its capabilities to emerging commercial and military applications and platforms, emergency responders, and environmental monitoring systems.

Contact: Xiaoxiao (Sherry) Wang, Sr. Program Manager
xwang@i-a-i.com 13012945247

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0442

Topic # N193-A01

WiseOwl

North Point Defense, Inc.

WHO

SYSCOM: NAVSEA

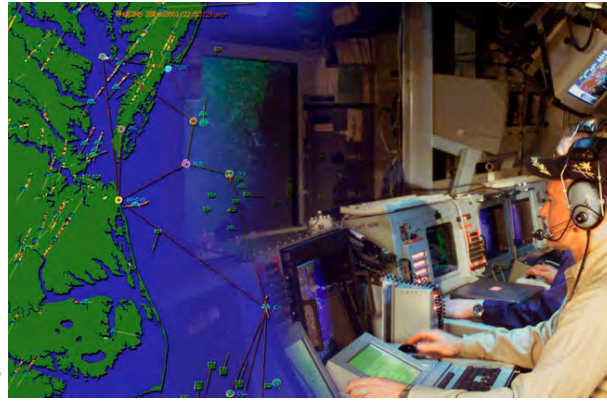
Sponsoring Program: PEO IWS 6

Transition Target: AN/USG-2, AN/USG-3 Cooperative Engagement Capability (CEC) Increment 2

TPOC:
(202) 781-3014

Other transition opportunities: US Navy Battle Damage Assessment; US NORTHCOM/FAA Air Defense; DHS Customs and Border Patrol; US Navy Aegis Common Source Library; Multiple DoD/IC SIGINT collection platforms

Notes: North Point Defense (NPD) has developed modular software capabilities for seamless integration with multiple architectures. Capabilities developed by NPD can be rapidly transitioned as individual components or entire NPD-developed system. Technology developed by NPD can potentially be applied to a broad array of signals and protocols throughout the Navy/DoD/IC SIGINT community.



<https://www.dote.osd.mil/Portals/97/pub/reports/FY2020/navy/2020cec.pdf>
ver=NtlUSS-pKu-29bCxZVPqvg%3D%3D

WHAT

Operational Need and Improvement: As Automatic Dependent Surveillance-Broadcast (ADS-B) sensors are integrated with signal collection units, algorithms to process and derive intelligence from this data are required. Artificial Intelligence and Machine Learning (AI/ML) has the capability to pull out important pieces of information from data rich environments such as ADS-B. Furthermore, modern AI/ML approaches can transform overwhelming amounts of data that can only be analyzed with simple, archaic algorithms into a rich source of actionable intelligence detecting anomalies beyond human capacity.

Specifications Required: The solution shall aim to develop algorithms using AI/ML approaches to characterize aircraft behavior. Specifically, these algorithms will identify air corridors and detect anomalous behavior. Aircraft exhibiting anomalous behavior should be identified on a continuous basis feeding upstream systems such as Combat Identification. Although ADS-B data feeds are uncharted territory for the CEC platform, customer reviewed metrics include accuracy and false alarm rate.

Technology Developed: NPD is developing a suite of independent machine learning algorithms to analyze and detect anomalies in ADS-B messages in near real-time. The first is a Deep Neural Network (DNN) approach that verifies whether the RF signature of the data matches the expected signature for that aircraft. This algorithm will detect, in real-time, an instance of a message spoofing attack or, in other words, when ADS-B messages are broadcast with an impostor ICAO address. Beyond that, NPD has also developed algorithms for the following: identifying abnormal flight patterns (e.g. figure-8), clustering tracks to identify apparent air corridors and outliers, comparing aircraft kinematics with the physical limitations of the airframe; multilateration (geolocation) using several ADS-B sensors, and finally comparing tracks in instances when more than one source of track data are available. NPD has integrated these modules in a framework that includes ADS-B collection, message and track aggregation, and data cleaning in near real-time with multiple sensors.

Warfighter Value: The application of AI/ML algorithms enables far more collected data to be processed and allows discovery of anomalous behavior that would have gone unnoticed without such algorithms. Because ADS-B is publicly broadcast data, anomalies detected in this domain could indicate a degree of nefarious activity intending to conceal enemy behavior or mislead U.S. collection assets. Detecting these events allows the operator to gain a better understanding of the true air picture in real time.

WHEN

Contract Number: N68335-20-F-0543 **Ending on:** November 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Receiving and storing In-Phase and Quadrature (IQ) ADS-B samples	Low	>= 1GB of raw IQ data collected	6	September 2020
Detection of aircraft inconsistencies using known performance characteristics	Med	>= 85% detection of inconsistent aircraft performance	6	December 2020
Detection of spoofed messages from RF signature	Med	>= 80 detection of anomalous/spoofed messages	6	June 2021
Demonstration of prototype system	Med	Accurately identify anomalies in real time with live ADS-B collections.	6	September 2021

HOW

Projected Business Model: NPD plans for technology insertion for either overall system architecture or individual components and intends to transition this technology to the prime integrator for the AN/USG-2 CEC system via a software license agreement. NPD also intends to provide the developed software to other Government agencies via direct sale to the Government or software license agreements and can support routine software upgrades and maintenance. All technology is software-based and has a simple interface to expedite integration and transition.

Company Objectives: NPD seeks Government arrangement of test and evaluation in operationally relevant environment either through direct contract or through the prime integrator's test environment. While the algorithms developed as part of this software solution specifically target ADS-B data, there is potential for algorithms to apply more broadly to multiple other signals with minimal parameter tuning. As such, NPD is also seeking partners throughout the SIGINT community for potential technology transition in other signal collection environments.

Potential Commercial Applications: Other potential applications include enhancing maritime and border security for US Coast Guard counter-narcotics mission as well as improving Federal Aviation Administration's situational awareness for homeland security. Other potential applications include investigations into aircraft traffic patterns and anomalous behavior for specific aircraft (e.g. corporate aircraft, foreign government-owned aircraft, etc.).

Contact: Benjamin Pokines, Sr. Systems Engineer
bpokines@northpointdefense.com 315.571.0221

Company	Topic #	Project	SYSCOM
Dirac Solutions Inc.	DOE16-030	Wireless Inter-Communications System	NAVAIR
Mission Secure, Inc.	N181-035	Network Traffic Analysis for Cybersecurity for Navy Industrial Control Systems	NAVSEA

WHO

SYSCOM: NAVAIR
Sponsoring Program: PMA-275
Transition Target: PMA-209
TPOC:

Other transition opportunities: Army Air Warrior Integration, Navy nuclear submarines, DHS

Notes: Robust RF communications from V-22 Osprey cockpit to crew inside aircraft and from cabin to outside for at least 300 ft with no dead-zones.

High reliability in presence of metals and radar interference. Prototypes are being evaluated for full certification under MIL-STD 461G RS103, RE102, CE106.

Secure communications, currently with AES encryption, NSA Type 1 encryption (next step).
Integration of the Base station with V-22 Osprey intercom.
Handheld and helmet mounting units for crew and pilot.



google search, <https://nationalinterest.org/tag/v-22-osprey>

WHAT

Operational Need and Improvement: There is a need for Wireless Intercom System (WICS) to allow V-22 Osprey aircrew members to communicate with each other without being physically "tethered" via an intercom cord, both within the aircraft, and external to the aircraft when on the ground. The WICS needs to provide reliable connectivity between the base station inside the aircraft and mobile units inside and outside without experiencing any dead-zones while being resilient to electromagnetic interference (EMI), without interfering with the aircraft control signals. The new WICS improves the crew connectivity by eliminating physical cables and the operational and safety issues associated with them.

Specifications Required: (1) Wireless transmissions between cabin crew members (in the air) and cabin crew members and external crew members (on the ground). (2) Minimum communications range of 300 feet (T), as measured from a crew member inside the V-22 Osprey cabin to a crew member external to the V-22 aircraft on the ground. (3) Base station integration with V-22 ICS (4) E3 certified with MIL-STD-461G, Test CE106 and RE102 (Helicopter Limits).

Technology Developed: DSI's wireless technology is based on ultra-wideband/wideband pulse based RF signaling and is specifically designed for harsh propagation environments where conventional wireless technologies face significant challenges. It offers reliable, high fidelity, and clear wireless voice communications, is resilient to multipath signal degradation/fading caused by heavy metallic structure of the aircraft, and is resilient to electromagnetic interference (EMI) from high power radars. DSI prototypes are being evaluated for certification for MIL-STD 461G RS103, RE102, CE106 and demonstrated success in limited ground testing in various DoD aircrafts (V-22 aircraft, Blackhawk, and Chinook helicopters), as well as successful test and demonstration in harsh environment of nuclear facilities for through the thick concrete wall communications. DSI has also developed similar wireless communications systems for DOE applications with wireless sensor data and image/video communications capability in nuclear facilities.

Warfighter Value: Reliable wireless communications can significantly enhance the warfighter operations as it eliminated the need for physical cables in tethered communications. The wireless communication capability reduces the operational risks related to cable integrity, as well as safety issues related to cables in various operational scenarios. The system can provide data and image/video communications can also be added to the system if needed by the warfighter.

WHEN

Contract Number: N68335-19-C-0220 **Ending on:** April 30, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Reliable wireless communication for V-22 up to 300 ft.	Low	Audio testing in/around V-22	6	April 2021
Extended communications range	Low	Audio testing in/around V-22	6	March 2022
Certification testing (CE106, RE102)	Low	Certification by independent lab	6	March 2021

HOW

Projected Business Model: DSI's business model is to transition innovative research to high TRL through SBIR phase I, II, and III projects and target various applications based on the similar technologies. DSI's current strategy includes working with prime defense contractors for mainframe integration and welcomes the opportunity to test and sell directly to other government agencies if there are sufficient interests.

Company Objectives: DSI's objective is to innovate and develop next generation wireless systems with emphasis on reliability, security, low cost and low power. DSI targets DoD applications including aircraft and submarine communications as well as underground tunnel / and skyscraper communications for DHS allowing for sensor data, and image/video applications. DSI also targets vertical markets for communications in harsh propagation environments in DOE applications such as wireless sensor data/image/video communications through thick concrete walls (containment) of nuclear reactors (applicable to Navy nuclear reactors also), as well as first responder communications in nuclear emergency response teams (applicable to firefighters also).

Potential Commercial Applications: Communications in nuclear facilities, shipboard communications, commercial avionics communications, urban communications, integration with 5G/6G densification networks, and integration with SATCOM.

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0377

Topic # N181-035

Network Traffic Analysis for Cybersecurity for Navy Industrial Control Systems

Mission Secure, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program:

Transition Target:

TPOC:

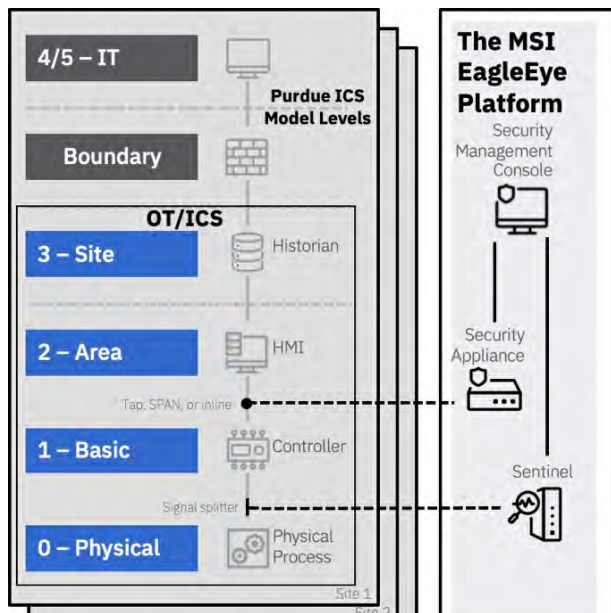
(202)781-2072

Other transition opportunities:

- Naval Surface Warfare Center (Philadelphia) – laboratory/operational testing platform's ability to protect multi-PLC network in 2021

- NAVSEA PMs – research-based, STP-assisted discussions in 2022
- Near targets: USCG, Military Sealift Command, NOAA, FAA, JSOC, SOCOM Remote Systems

- MSI's commercial offering lends perfectly to DoD installation cybersecurity requirements for critical infrastructure (e.g., potable water, fuel distribution, electricity)



Mission Secure, Inc. 2021

WHAT

Operational Need and Improvement: OT Cybersecurity for vehicle and weapons platforms have not kept pace with IT cybersecurity. Offensive cyber tools today far outpace most defensive tools. The Navy required the management of disparate PLCs under a unified platform and single console. In addition, given that sensor data contains potentially valuable clues on the future state of a given component, it required the same data also be used for predictive maintenance. The platform should also give indication as to whether anomalies in behavior are due to maintenance or malware.

Specifications Required: MSI built an ICS lab to include in-line protections, added PLC protocols, and several complex attack scenarios. The predictive maintenance model used real component data from diesel engines and electric relay components.

Technology Developed: Mission Secure provides cybersecurity for Operational Technology (OT)/ Industrial Control System (ICS) networks. MSI provides best-in-class protection and resilience through Zero Trust networks, enabling components to operate as they were intended. The platform also allows the warfighter to tap into rich data provided by sensors and the network, for forensics and predictive maintenance. As a commercial product/service company that already manufactures, deploys, and monitors systems across several industries, MSI provides a low-risk solution from a proven manufacturer with high quality control.

Warfighter Value: Mission Secure's provides warfighters a defensive cybersecurity platform better than the adversary's offensive cyber tools. In a single dashboard, the MSI platform provides visibility and protection to critical OT networks, enabling components to operate as they were intended. The platform also allows the warfighter to tap into rich data provided by sensors and the network, for forensics and predictive maintenance. As a commercial product/service company that already manufactures, deploys, and monitors systems across several industries, MSI provides a low-risk solution from a proven manufacturer with high quality control.

WHEN

Contract Number: N68335-20-C-0141 **Ending on:** October 7, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
SBIR Option Year 1 completion	Low	relay failure modes entered	6	September 2021
NSWC environmental testing	Low	ship PLCs integrated; attacks successfully defended	8	March 2022
Navy program signs contract/PO	Low	Phase 3 contract signed	8	April 2022
Platform deployed onto USN ships	Low	OT/ICS network assessed; Solution deployed and validated; operators trained	9	October 2022

HOW

Projected Business Model: MSI intends to apply the technology proven in SBIRs and STTRs and commercial applications to manned and unmanned systems. Mission Secure has a unique combination of cyber security, data analytics, machine learning, and network/communications capabilities. It can sell the platform directly to the Government or through an OEM. It will provide any systems/weapon-specific assessments and design engineering, as required, then support testing and integration. It can also provide post-deployment monitoring and expertise, as appropriate.

The OT cybersecurity market is a rapidly growing space for which the Government is quickly assessing procurement options. MSI is well-poised to provide an array of similar platforms in support of our nation's military.

MSI expects to deploy hundreds of systems in support of Platform Aero's Vanilla UAS and the USN in 2022. A Navy official believes it is the most "cyber secure UAS in the Navy."

Company Objectives: Mission Secure will pursue unmanned and manned systems, including shipborne, aircraft, vehicle, and satellite systems. It intends to pursue product/service contracts for specific systems, but also IDIQ contracts with machine learning platforms that handle varying environments and hardware systems with the support of AI/ML-leading Virginia Tech. The innovations from Defense projects will add features to the company's commercial offering.

Potential Commercial Applications: Our commercial platform provides strong protection and resilience for its customers. Our recent Defense research projects and Virginia Tech partnership adds considerable capability applicable to our commercial offering. Mission Secure's unique combination of cyber security, network/communications capabilities, data analytics, and machine learning create opportunities previously unavailable. Our intent is to reinforce success in the markets we have already penetrated, including unmanned systems, maritime, aviation, energy, and smart cities.

Contact: Bob McAleer, President
BMcAleer@missionsecure.com

571-484-3001

Company	Topic #	Project	SYSCOM
Pendar Technologies, LLC	N181-016	Two-Dimensional Surface Emitting Mid-Wave Infrared (MWIR) Quantum Cascade Laser Arrays for High-Power Applications	NAVAIR
Tau Technologies LLC	N172-118	Laser Target and Analysis Board Development	NAVAIR

Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2022-16

Topic # N181-016

Two-Dimensional Surface Emitting Mid-Wave Infrared (MWIR) Quantum Cascade Laser Arrays for High-Power Applications

Pendar Technologies, LLC

WHO

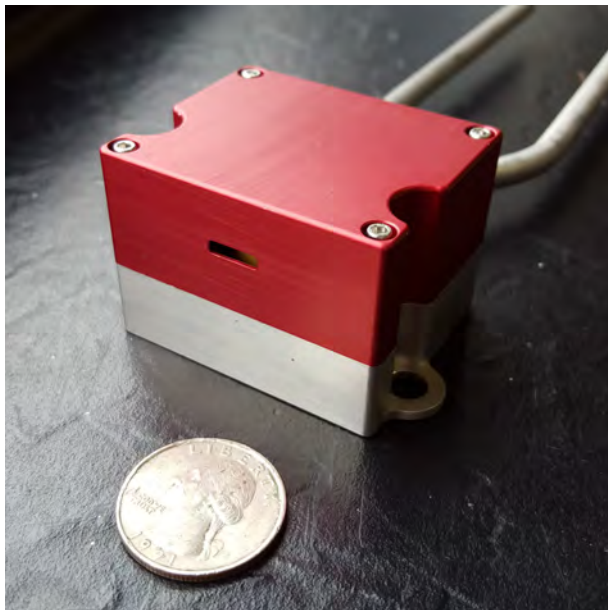
SYSCOM: NAVAIR

Sponsoring Program: PMA 272
Tactical Aircraft Protection Systems

Transition Target: Infrared Countermeasures (IRCM)

TPOC:
(760)939-0239

Other transition opportunities: Mid-wave and long-wave infrared (MWIR, LWIR) lasers coupled to imaging systems for military, law enforcement, and civilian applications including; target acquisition, situational awareness (infrared scene illumination), industrial process control, remote sensing, obstacle avoidance, and selective etching, cutting, and marking of materials.



High Power mid-wave infrared (MWIR) laser modules developed by Pendar Technologies.

WHAT

Operational Need and Improvement: This advance is aimed at the realization of a monolithic, high power laser source based on a beam-combined surface-emitting Quantum Cascade Laser (QCL) array. The benefits of this program include lower production costs, higher power on target, improved reliability, and simple integration.

Specifications Required: The main goal of this SBIR topic is to develop a MWIR QCL source based on a cost-effective architecture similar to that of high-power, two-dimensional VCSEL arrays.

- Single, monolithic chip architecture.
- Power levels exceeding 200 Watts during CW operation.
- Implement innovative thermal management solutions to eliminate the need for active water cooling.
- Develop beam combining scheme maximizing the brightness of the source.

Technology Developed: - Surface emission (SE) with near-diffraction limited beam-profile has been experimentally demonstrated.

- Narrow-ridge, high-yield buried heterostructure process compatible with surface emission has been developed.
- Multi-Watt output power of Fabry-Perot arrays demonstrated.

Warfighter Value: - High-power MWIR QCL emitter enable effective infrared countermeasure systems in a low SWaP package.

- Narrow BH QCLs have inherently stable and excellent beam quality without beamsteering, enabling long distance propagation.
- Surface emission capability results in improved reliability and enables low-cost testing and burn-in, resulting in significant cost reduction.
- Affordable, high power MWIR QCL source are a game changer for many military applications.

WHEN

Contract Number: N68936-19-C-0052

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Monolithic High Power QCL Arrays	Low	Output Power	6	December 2022
Beam-combined High Power Arrays	Med	Brightness	5	December 2022
Surface-Emitting Arrays	High	Brightness, Reliability	4	December 2022

HOW

Projected Business Model: There are aspects of the countermeasures technology chain that drive Pendar toward collaborative supply relationship with one or more Primes. Pendar alone cannot furnish a fully integrated IRCM system, including all steering and electronics. Pendar is actively pursuing opportunities to transition laser prototypes emerging from this and other SBIR/STTRs into next generation systems. Additionally, advances made in this program will more broadly benefit the commercialization of Pendar's IR platform, including spectroscopic instrumentation.

Company Objectives: To address the different markets in need for affordable, compact mid-infrared sources, Pendar has developed several infrared platforms which all share and leverage our proprietary QCL designs, beam-combining solutions, and system innovations:

1. Broadly tunable single-mode laser array as general spectroscopy tool.
2. Compact, high performance IR spectrometers and sensors.
3. Reliable high-power lasers and laser bars for IRCM, and other DoD applications.

Potential Commercial Applications: Pendar has developed several proprietary mid-infrared QCL platforms, which have unique features such as broadband spectral coverage, arrays with high optical power through power scaling, excellent beam-quality through rugged wavelength beam-combining, low laser noise, fast tuning speed, and low SWaP due to monolithic nature of laser source. These advantages enable a host of applications in IRCM, spectroscopy, medical device, pharma, laser processing, and scientific applications.

Contact: Christian Pfluegl, Principal Investigator
cpfluegl@pendar.com (857) 413-9339

Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-850

Topic # N172-118

Laser Target and Analysis Board Development

Tau Technologies LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: Advanced Tactical Aircraft Protection Systems Program Office (PMA-272)

Transition Target: Large Aircraft Infrared Countermeasures (LAIRCM) System Prime Contractors, other DoD using Commands

TPOC:
(812)854-3180

Other transition opportunities: Laser Target and Analysis Board (LTAB) permits high fidelity testing of directed energy (laser) based systems in a real world environment. Potential users include the Air Force Research Laboratory (AFRL) Directed Energy Directorate, civilian users of lasers, such as optical communications systems, astronomical guide star imaging systems

Notes: Tau Technologies has been a key player in the development of high fidelity computer models of directed energy-related phenomena, supporting laser research and development. In support of the Directed Energy Test, Science & Technology program (DET S&T), Tau Technologies developed a fully polarized, anisotropic, wavelength- and temperature dependent Bidirectional Reflectance Distribution Function (BRDF) model. The BRDF is a critical component in predicting target signatures and reflected laser energy. Tau employs this model to support a wide range of active and passive applications



Image courtesy of Tau Technologies.

WHAT

Operational Need and Improvement: With many airborne laser systems now being produced and fielded such as Large Aircraft Infrared Countermeasures (LAIRCM) and DoN LAIRCM, etc., the need for low-cost, near real-time evaluation of the system parameters is rapidly becoming prevalent. There currently exist few (if any) self-sustained and rapidly deployable laser receiver target boards that merge the measurement of divergence, power, and pointing accuracy. This combination of ground-based sensor evaluation techniques is needed for use in austere environments.

Specifications Required: Airborne laser-based systems now being produced and fielded require in-situ evaluation of the laser system's performance. System must test the laser on a relevant platform (i.e. helicopter), in a relevant environment, with the ability to collect data on the target at range (> 1 km). The equipment must operate from prepared/unprepared sites. System must measure critical laser beam characteristics, recording data for immediate and post-event analysis. Laser specifications may vary from test to test, so system must be flexible in data collection methods. System must perform beam measurements at relevant ranges (1-10 km). Testing can be performed with operational and developmental lasers, from static positions and fielded platforms, in real-world conditions. System setup/teardown: < 2 hours.

Technology Developed: Tau Technologies' LTAB utilizes physics-based algorithms that can accurately analyze beam characteristics/waveforms at range, performing measurements of divergence, power, pointing accuracy and other characteristics, and is easily transportable. LTAB utilizes physical characteristics of far-field beam to provide detailed beam analysis. Simulation results confirmed high accuracy beam parameter measurements from a sparse array of discrete detectors, at very high sample rates. LTAB can detect/characterize jitter direction, cumulative power, frequencies and amplitude. LTAB analysis permits quantification/attribution of high frequency disturbances. LTAB--an adaptable design using an integrated commercial off-the-shelf (COTS) approach.

Warfighter Value: This program can save lives by providing detailed confirmation, in situ, of aircraft self-protection system functionality. The LTAB program provides a versatile system for testing laser sources used in the LAIRCM and other similar systems. The complex beam characteristics of LAIRCM systems must be tested to verify function, supporting aircraft and aircrew survival in a hostile environment.

WHEN

Contract Number: N68335-19-C-0195 **Ending on:** April 8, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase 1 SBIR: Concept Development	Med	Modeling and simulation of sparse array concept successful, preliminary target board design complete	3	March 2018
Phase 2 SBIR: Prototype design and build	Low	Prototype build, initial test and checkout complete	5	February 2021
Phase 2 SBIR Enhancement: Prototype Test	Low	Prototype delivery, acceptance testing (currently ongoing) at customer range	6	July 2021

HOW

Projected Business Model: Tau Technologies is actively looking to commercialize this Laser Target and Analysis Board technology, either directly to the DoD or to a prime associated with large aircraft self-defense systems that this technology can support. We also believe this technology can directly support directed energy weapons research by providing field beam measurement capability that currently does not exist. Tau Technologies has the capability to support manufacturing of medium quantities of these devices, and has established connections with contract manufacturers to support custom detector manufacturing requirements. Tau Technologies has already fielded a Phase 2 prototype, and this device has successfully completed acceptance testing at the customer's test range.

Company Objectives: Tau Technologies' world-class expertise in laser beam propagation modeling and simulation, coupled with its design and manufacturing capabilities demonstrated in the LTAB prototype, position it as a stand alone leader in directed energy-related field test systems. Tau Technologies continues to look for other laser-related programs, both in and out of DoD, that could benefit from this breakthrough technology program. This program can also provide adaptable field testing capabilities supporting future laser-related weapon system development.

Potential Commercial Applications: The capability to accurately test and characterize a laser beam, propagated through the chaotic atmosphere, is an invaluable asset to programs that provide defensive countermeasures for the warfighter. LTAB can provide large amounts of beam information, permitting validation of implementation models, verification of threat-specific features, and characterization of beam behavior as a result of aircraft maneuvering. LTAB provides a capability long missing in the directed energy research community--the ability to characterize a laser, in a realistic environment, to determine "power in the bucket", beam quality, tracking system accuracy, and atmospheric-induced beam perturbations. In the civilian research field, the LTAB concept can provide the astronomical community the ability to test and accurately characterize laser guide star systems, used with adaptive optics systems. Emerging free space optical communications could utilize LTAB capabilities to verify system performance in specific installation situations.

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Company	Topic #	Project	SYSCOM
Advanced Cooling Technologies, Inc.	N191-044	Undersea Energy Harvesting from Benthic Gas Seeps and Hydrates	ONR
Mantel Technologies	N19A-T013	Power Dense Turbo-Compression Cooling Driven by Waste Heat	NAVSEA
Omnitek Partners, LLC	N151-060	Power Technologies for Navy Conventional Ammunition Fuzes	NAVSEA
Physical Sciences Inc.	N18A-T008	Additive Manufacturing for Li-Ion Batteries	NAVAIR

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-8875-21

Topic # N191-044

Undersea Energy Harvesting from Benthic Gas Seeps and Hydrates
Advanced Cooling Technologies, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Multiple program offices have interest in undersea energy harvesting.

Transition Target: TBD

TPOC:

Dr. Harold Coombe

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Other transition opportunities: Other transition opportunities from this project including liquid fuel reforming for portable power, deep sea methane seep collection (avoid hydrate formation), submarine life support system, heat pipe thermal management for underwater applications

Notes: 1. Demonstrated heat pipe based collection system to avoid hydrate formation

2. Developed seep collection system

3. Achieved high temperature reforming reaction via additive manufacturing of SiC Swiss-roll reformer

4. Demonstrated CO₂ storage and O₂ generation via KO₂ reactor



<https://www.usgs.gov/news/seeking-seeps>

WHAT

Operational Need and Improvement: Prior research has focused on investigating benthic seep and hydrate characteristics (chemical makeup, flow, etc.), understanding associated biological lifeforms, and prediction of benthic seep and hydrate locations. Lacking is any substantive research into the potential for these energy resources to serve as sources for seabed energy conversion/storage for operational use. The Navy is currently pursuing development of technology to convert energy from seafloor hydrothermal vents and is conducting research in the area of seafloor microbial fuel cells. There are also prior and ongoing efforts to harvest energy from tidal and wave energy, as well as Ocean Thermal to Electric Conversion.

Specifications Required: Develop technologies to harvest, store, and utilize methane and other gases from benthic gas seeps and hydrates for seabed electric power production. Continuous kilowatt-scale electrical output from a single device is of interest. The design should take into consideration potential fouling of the system, a desired system lifetime of 2 years (without maintenance), the depth ranges for seeps and hydrates, and ease/practicality of system deployment. Minimizing system and deployment costs is important. It is critical to understand the biological and geological environment near benthic seeps and hydrates such that compatible technologies are pursued and ultimately developed and fielded.

Technology Developed: Novel methane harvesting system to utilize the sea floor cold seeps to extend the endurance of undersea activities. The technology aims to collect and convert abundant chemical energy in the methane seeps into electricity. The proposed technology has effective thermal and chemical integrated design to minimize the size and weight requirement. In addition, the proposed collector design is able to avoid the fouling issue during the collecting process for a wide depth range. The system proposed by ACT is self-sustained and able to provide kilowatt-scale electrical output for 2 years without any maintenance and logistic requirement.

Warfighter Value: Several underwater activities rely on battery to provide power, which has relative short endurance time. The abundant chemical energy in the seabed methane seeps could potentially be used as an energy source for battery charging enabling one to significantly extend the operational time for underwater activities.

WHEN

Contract Number: N68335-20-C-0579 **Ending on:** June 24, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Scale up KO ₂ reactor	Low	Scale up KO ₂ reactor with acceptable pressure drop	5	4th QTR FY21
Integrate KO ₂ reactor with fuel cell	Med	Able to capture all the CO ₂ from the downstream of the anode exhaust and release sufficient amount of oxygen	5	1st QTR FY22
Achieve high reforming efficiency of Swiss-roll reformer	Med	Achieve > 80% reforming efficiency with acceptable intermediate products	5	1st QTR FY22
Demonstrate integrated fuel cell and KO ₂ operates in underwater environment	High	Test fuel cell with KO ₂ reactor in underwater environment for half hour operation	6	2nd QTR FY22
Integrate Swiss-roll reformer with fuel cell	High	Demonstrate fuel cell power generation from reformat	6	3rd QTR FY22
Demonstrate methane seep collection system	Med	Able to collect methane seep at Coil Oil Pointection system	7	3rd QTR FY22

HOW

Projected Business Model: ACT plan to work with the companies who are interested in one or more of the technologies developed under this project and apply the technologies to their specific applications. Once the technologies can be successfully demonstrated, ACT will be the supplier for the technology.

Company Objectives: The technologies developed under this project can benefit several different companies. 1. Companies who are interested in methane seep collection. 2. Companies who are interested in underwater thermal management using heat pipes. 3. Companies who are interested in life support system. 4. Companies who are interested in liquid fuel reforming.

Potential Commercial Applications: The underlying technology may be utilized for liquid fuel reforming. Liquids derived from biomass resources—including ethanol and bio-oils—can be reformed to produce hydrogen in a process similar to natural gas reforming. Biomass-derived liquids can be transported more easily than their biomass feedstocks, allowing for semi-central production or possibly distributed hydrogen production at fueling stations. Biomass-derived liquid reforming is a mid-term technology pathway.

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NAVSEA #2021-0388

Topic # N19A-T013

Power Dense Turbo-Compression Cooling Driven by Waste Heat

Mantel Technologies

WHO

SYSCOM: NAVSEA

Sponsoring Program: PMS460

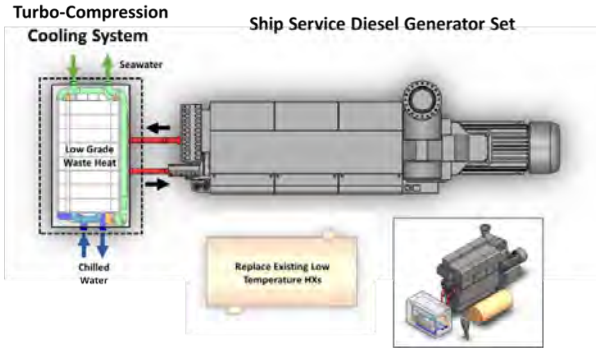
Transition Target: LPD, DDG(X)

TPOC:

Samuel Mwangi,
samuel.mwangi@navy.mil

Other transition opportunities:
Installation Energy, Base Resilience

Notes: The TCCS captures waste heat from SSDG and converts it into cooling capacity. Key discriminators of the TCCS are its ability to utilize low-grade waste heat, its ability to handle fluctuations in waste heat availability, its multi-modal operation which affords for both cooling and electricity generation, and its compact size.



Courtesy Mantel Technologies

WHAT

Operational Need and Improvement: The US Navy seeks to increase the power density of existing power generation equipment such as shipboard service diesel gensets (SSDGs) in order to accommodate the power and cooling needs of emerging and future weapon systems.

Specifications Required: Increase SSDG efficiency by at least 10% through recovery and conversion of waste heat to cooling and/or electricity without increasing footprint, volume or weight of incumbent chiller system.

Technology Developed: The turbo-compression cooling system (TCCS) is an efficient, compact means of recovering and converting low temperature waste heat into cooling capacity. The system maximizes the use of COTS components to support maintainability objectives.

Warfighter Value: Implementation of the TCCS will result in improved efficiency of shipboard service diesel gensets (SSDGs). By improving SSDG efficiency, the TCCS reduces fuel costs and supports ship resilience.

WHEN

Contract Number: N68335-20-C-0630 **Ending on:** January 1, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase II Full Scale System Design Complete	Low	Successful Critical Design Review	3	May 2021
Phase II Test System Assembled	Low	100-ton Cooling Scale System Assembled	3	May 2022
Preliminary Phase II System Test Report	Low	Report Summarizing Test Outcomes	4	July 2022
Phase II Full Scale System Design Refined	Low	Design Updated Based on Test System Outcomes	4	July 2022
100-Ton Scale TCCS Shipboard Test and Evaluation	Med	System Meets Performance Requirements at 100-ton Scale in a Shipboard Environment	7	December 2023
Full-Scale Militarized TCCS Shipboard Test and Evaluation	Med	System Meets Performance Requirements at Full-Scale in Shipboard Environment	8	December 2025

HOW

Projected Business Model: Mantel has established a subsidiary, Harvest Cooling, to commercialize the TCCS. We envision a business model including both direct sales and sales through channel partners. A 200-ton-scale TCCS for US Navy shipboard applications will be the first product pursued. In parallel, will investigate additional shipboard models and will also pursue land-based/installation versions of the TCCS.

Company Objectives: Mantel seeks to deliver waste heat recovery solutions via its Harvest Cooling subsidiary. For US Navy shipboard applications, we aim to establish relationships with the appropriate shipbuilders and diesel engine manufacturers as required to gain support for inclusion of the TCCS for both retrofit and new build opportunities. For land-based applications, we aim to drive growth via pilot operations at industrial sites where waste heat is abundant and then for cooling is significant. Our vision is to establish the TCCS as a key enabler for energy resilience.

Potential Commercial Applications: The TCCS has great potential for impact in any application where there is a reliable supply of waste heat, either from energy production or other industrial processes, and a need for cooling. Markets include the food processing industry, commercial CHP and data centers.

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NAVSEA #2021-0375

Topic # N151-060

Power Technologies for Navy Conventional Ammunition Fuzes

Omnitek Partners, LLC

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS 3C
(Naval Gunnery Systems)

Transition Target: Conventional
Ammunition - Fuzing

TPOC:
(973)724-9475

Other transition opportunities:

Notes: Thermal battery prototypes and their x-ray image without (left) and with (right) fully integrated heating fuse strips measuring 200-300 percent increase in run-time. The batteries are fabricated using standard fabrication techniques by Advanced Thermal Batteries, Inc., the project subcontractor, making it ready for mass production preparation phase. Thermal reserve batteries are the primary source of power in gun-fired munitions, bombs, rockets and missiles with increasing demand on their run-time with increased onboard electronics and range.



WHAT

Operational Need and Improvement: Thermal reserve batteries are the primary source of power in gun-fired munitions, bombs, rockets, missiles. For relatively small battery sizes used in these applications, current thermal batteries can stay activated for around 40-100 seconds, the run-time requirement for longer range munitions are several minutes, at times in excess of 10 minutes. The Omnitek Partners developed technology increases thermal battery run-time performance more than 200-300 percent depending on the size of the battery – higher percentage increase for smaller batteries - as required for most new and legacy replacement military applications. In all munitions applications, thermal reserve batteries with longer run-time translates to a smaller battery size, thereby more valuable space for system electronics and sensory systems for higher operational precision and higher lethality.

Specifications Required: Improve thermal battery runs time 200-300% over current capabilities. Also reduce battery rise time to 5-7 msec."

Technology Developed: Omnitek, in collaboration with its subcontractor (Advanced Thermal Batteries, Inc.) has developed a novel thermal reserve battery technology. The battery core is packaged inside a layer of slow burning/heat generating fuse strip to maintain the battery core temperature above the melting point of its electrolyte following activation, significantly increasing the battery run-time, particularly for smaller batteries used in gun-fire munitions, rockets and missiles by 200-300 percent and more. The novel method of fabricating heating fuse strips is ready for mass production. Battery fabrication methods currently used require the simple step of adding the coiled heating fuse strip between insulation layers. The heating fuse strip is ignited with battery activation initiation train. A hybrid version of reserve battery for gun-fired munitions uses a piezoelectric to generate power during the battery rise-time.

Warfighter Value: Thermal reserve batteries are the primary source of power in gun-fired munitions, bombs, rockets, missiles, generally designed to satisfy application run-time by increasing their size (heat mass). The Omnitek Partner technology allows the design and fabrication of smaller batteries for a given run-time requirement. As a result, the battery would occupy a smaller valuable munition space. In all munitions applications, thermal reserve batteries with longer run-times would translate to a smaller battery size, thereby more valuable space for system electronics and sensory systems for higher operational precision and higher lethality.

WHEN

Contract Number: N68335-19-C-0158 **Ending on:** January 5, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial prototype fabricated and successfully tested	N/A	Increased battery run-time over 200 percent	5	September 2020
Fully integrated prototype designed, fabricated and tested	N/A	Increased battery run-time over 200 percent	6	February 2021
Fully integrated prototype designed, fabricated and initiated by realistic gun-firing shock-loading	Low	Increased run-time over 150 percent under load	7	August 2021
Fabrication of the replacement thermal battery for Navy application and activation by realistic setback shock loading	Low	Increased run-time 200-300 percent under load	7	January 2022

HOW

Projected Business Model: Currently, heating fuse tubes designed by Omnitek are filled with slow burning pyrotechnic material by Hanley Industries, Inc. in Alton, Illinois (project subcontractor). Coiled and consolidated heating fuse strips with ignition fuse end are then fabricated at Omnitek for each battery diameter and length and shipped to Advanced Thermal Batteries, Inc. (ATB) in Westminster, Maryland (project subcontractor) for battery fabrication. The process of filling the heating fuse tubes and their consolidation and coiling to the battery size requirement are currently performed manually and requires to be automated to achieve lower cost and to satisfy the expected high product demand. Omnitek's current business plan is to have two sized tube filled with slow burning pyrotechnic material to be fabricated by its pyrotechnic vendor(s) - including Hanley Industries, Inc. - and form consolidated heating fuse coils for each battery size order and supply them to battery manufacturers (like ATB) for battery production.

Company Objectives: Omnitek's current business plan is to acquire tubes filled with slow burning pyrotechnic material as designed by Omnitek from its pyrotechnic vendors and form consolidated heating fuse coils for each battery size order and supply them to battery manufacturers for battery production. Omnitek has successfully developed many different technologies for the military and for the commercial market that since 2000 has resulted in over 230 U. S. Patents. Omnitek has developed several critical components for gun-fired munitions, rockets, missiles and bombs from concept to full production and is currently the main developer and manufacturer of initiation devices with full safety features for reserve batteries and initiation trains for the military.

Potential Commercial Applications: Thermal reserve batteries, particularly those with significantly increased run-time, have potential applications for emergency use, particularly for operating emergency equipment in remote areas and when facing power outages. For example, thermal batteries can provide high current for quickly opening and closing valves along gas and oil pipelines in remote areas when under duress or in emergency conditions. Thermal batteries, with their 20-30 year shelf life are ideal for such emergency operations of safety equipment without line power.

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NAVAIR

Topic # N18A-T008

Additive Manufacturing for Li-Ion Batteries (Phase II)

Physical Sciences Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 275

Transition Target:

TPOC:

Other transition opportunities:

Navy to power next generation electronic equipment and vehicles.

Notes:

Imperia's processing techniques for solvent-free production of high performance lithium-ion components:

- Reduce manufacturing cost
- Eliminate waste
- Can enable production of complex geometries such as interdigitated electrodes
- Increase cell architecture design versatility

Manufacturing processes could be used to produce higher performance batteries for all Navy and DOD applications. Current cells are being built to demonstrate the advantages and ability to use as a drop in replacement for traditionally produced components.

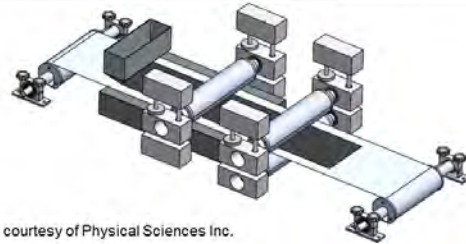
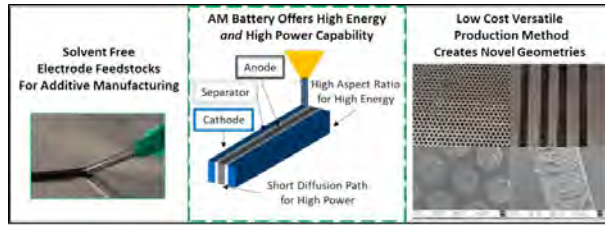


Image courtesy of Physical Sciences Inc.

Direct from powder scale up system: Powder is deposited and spread to the targeted loading before compression into the final electrode

WHAT

Operational Need and Improvement:

Current electrode processing techniques require significant solvent quantities and cells can only be created using electrode stacking or rolling.

Specifications Required:

- Compatible with traditional and next generation materials.
- Insertable into current manufacturing lines.
- Reduced cost and environmental impact.
- Increased energy and power performance.
- Increased design flexibility.

Technology Developed:

Imperia has developed novel, high performance solvent-free Li-ion electrodes that enable production using Additive Manufacturing.

- Solvent-free processing reduces manufacturing cost by eliminating processing solvent and reducing electrode scrap.
- Electrodes are produced directly from powder and deliver improved power performance at high loading when compared to conventional electrodes.

Warfighter Value:

- The technology will enable rapid, scalable additive manufacturing production of high energy and power density lithium-ion batteries.
- The solvent-free manufacturing approach will decrease manufacturing costs, increase manufacturing throughput, and improve battery performance.
- Enable production of lithium-ion batteries that have both high energy and power characteristics improving versatility and simplifying design choices.

WHEN

Contract Number: N68335-19-C-0549 **Ending on:** December 20, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Produce solvent-free electrodes and integrate into a planar full cell.	N/A	Construction of functioning cells	3	December 2019
Produce solvent-free electrodes that demonstrate individually equivalent performance to traditional counterparts.	N/A	Electrochemical testing in conventional formats.	4	January 2020
Production process scale-up and pouch cell demonstration.	N/A	Demonstration of basic cell performance.	4	September 2020
Construction of roll-to-roll component production equipment.	N/A	Equipment constructed and validated to perform as designed.	5	April 2021
Full scale cell integration and performance demonstration.	Med	Demonstrate performance of the produced cells delivers the targeted energy and power density.	5	October 2021

HOW

Projected Business Model:

PSI's Imperia Batteries division operates a dedicated battery manufacturing facility in Wilmington, MA capable of producing ~1MWh of specialty Li-ion batteries per year. At this facility, Imperia produces specialty Li-ion batteries for PSI's small unmanned aerial systems (sUAS) that are being used in ongoing OCONUS military operations. Imperia brand batteries are tailored specifically to provide an optimum combination of battery performance by balancing energy density, power density, cycle life, safety, and cost. As a domestic ISO 9001 certified supplier, we provide a traceable and verifiable manufacturing process. This ensures that each cell and battery is manufactured with known test chemicals and verified processes. We are committed to working with our customers to deliver custom high performance energy storage solutions for their applications. The objective is to use the solvent-free manufacturing techniques to design, fabricate and deliver safe, high energy and power storage solutions for DOD customers.

Company Objectives:

PSI develops advanced technologies and products for the military, aerospace, industrial process, energy, telecommunications, environmental, and medical markets. PSI is strongly committed to developing products and services based on innovative technologies to support the missions of the Department of Defense. The mission of the Imperia Batteries division is to design, fabricate and deliver safe, high energy and power storage solutions for DOD customers.

Potential Commercial Applications:

This technology could be used to manufacture lower cost, higher performance batteries for use in:

- Consumer devices such as cell phones and laptops
- Electric vehicles
- High power laser systems
- Unmanned Aerial Vehicles (UAVs).

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Company	Topic #	Project	SYSCOM
Atmospheric Plasma Solutions	N151-022	Method for Removal of Airfield Paint Markings and Aircraft Tire Rubber Build-up from Installed AM2 Mat Surfaces	NAVSEA
Boston Engineering Corporation	N141-042	Autonomous or Remotely-Operated Maintenance of Ships Tanks	NAVSEA
Cornerstone Research Group, Inc.	N192-052	Electrical Load Management System (ELMS)	NAVAIR
Intelligent Automation, Inc.	N18A-T011	Nondestructive Evaluator for Polymer Ablatives (NEPAL)	NAVSEA
Physical Sciences Inc.	N192-126	A Chip-based Orbital Angular Momentum Receiver for Underwater Optical Communications	ONR
Technical Data Analysis, Inc.	N08-006	P-8A IAT Fleet Metrics Functionality for Structural Life Management	NAVAIR

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NAVSEA #2021-0378

Topic # N151-022

Method for Removal of Airfield Paint Markings and Aircraft Tire Rubber Build-up from Installed AM2 Mat Surfaces
Atmospheric Plasma Solutions

WHO

SYSCOM: NAVSEA

Sponsoring Program: PMA-251

Transition Target: PEO Carriers, TEAM Subs, PEO Ships, SEA 04

TPOC:

Other transition opportunities: Weapon system maintenance, Non Destructive Testing and Evaluation, Biofouling remediation

Notes: Pictured is the PlasmaBlast Atmospheric Plasma Coating Removal (APCR) system in operation for coating removal



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WHAT

Operational Need and Improvement: Atmospheric Plasma Coating Removal (APCR) addresses the immediate and growing need for a more environmentally friendly, operator-safe, cost-effective paint and coating removal solution for use on naval platforms and at naval facilities. This technology significantly reduces risks and hazards associated with media-based mechanical and chemical coating removal processes. The plasma coating removal technology has particular effectiveness where abrasive blasting is not easily deployed, specified or permitted. The plasma technology can be used to reduce costs for jobs including but not limited to Non-Destructive Inspections (NDI), weld prep, and spot coating removal.

Specifications Required: APCR has been demonstrated to be an effective alternative to media and wet abrasive blasting on a wide range of painted/coated surfaces, including steel and aluminum. The lightweight and intuitive system can be setup quickly and is easily operated by one user. The PlasmaBlast APCR system weighs less than 40 pounds and only requires compressed air and standard 240 or 480 volt power, making it a truly portable and easily-deployed system. The system can be safely used in confined or open spaces.

Technology Developed: The PlasmaBlast system uses electricity and compressed air to produce an air plasma beam. The power supply provides the electrical power to excite the air into the plasma state and the plasma pen forms and shapes the plasma beam. The APCR process converts a significant portion of the removed organic coating into water vapor and carbon dioxide, leaving behind less solid mass than was present in the original coating. The remaining solids are a dust which can be safely collected with a suitable vacuum filtration system. The plasma beam is scanned across a coated surface (manually or robotically) to remove the coating layer by layer, allowing for full or selective removal, in addition to cleaning and surface preparation.

Warfighter Value: This novel technology advances the Navy's goal of improving shipboard maintenance to increase the operational lifetime of ships and aircraft and other military assets. The implementation of the APCR technology will improve shipyard efficiency, lower maintenance costs, lower ship construction costs and shorten ship construction delivery timelines. During demonstrations and testing at Naval shipyards artisans and technicians have found the system to be a benefit because of less vibrational impact and reduced PPE.

WHEN

Contract Number: N68335-20-C-0384 **Ending on:** May 1, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Based on field testing the system was improved ease of use, portability and ergonomics	Low	Significant changes well received based on positive feedback from users of the system	TRL-7	January 2017
Awarded Best New Technology 2019 US DOD Commercial Technologies for Maintenance Activities	Low	Presenation at Maintenance Innovation Challenge	TRL-8	June 2019
Robotic system designed, tested and acquired by Newport Newship yard for use in CVN construction	Low	Testing, data collection and analysis conducted on platform	TRL-8	April 2020
Systems acquired and implemented by US Army for amored vehicle maintenance	Med	Reduced repair time and risk of worker injury	TRL-9	June 2021
Systems acquired by PHNSY for NDT/NDI	Low	Improved ability to conduct inspection on critical welds	TRL-8	July 2021
Two sytems purchased by TRF Bangor in FY21 for training and process development	Low	Replace needle-guns, improves ability to inspect welds and plates	TRL-8	September 2020

HOW

Projected Business Model: The PlasmaBlast APCR systems are available now in the the single beam precision coating removal system PB-7000. There are three models - Mobile, Robotic and Bench. A SBIR project is underway to produce data and analysis to more fully qualify the technology and system on a broader range of coatings and substrates including the HY series of metals. An increasing number of use cases are being validated in field tests that prove out the value of deployment in the public shipyards, IMFs and with prime contractors.

Company Objectives: To introduce the world's first environmentally responsible, atmospheric plasma coating removal system based upon a patented PlasmaBlast APCR technology that quickly and safely removes protective coatings. The current product is ideal for removing coatings and sealants from intricate fittings and parts, for NDI applications, and significantly reducing or eliminating the need for additional surface preparation prior to recoating. Technology development programs are currently underway to achieve higher production rates and to enable technology integration into readily available coating removal platforms, including robotics. These advancements are intended to create cost-and time-effective solutions for large-scale projects

Potential Commercial Applications: The APCR technology is the next generation of surface preparation solution marine, aviation, oil and gas, transportation and most other commercial industries where protective coatings are used. The company has deployed the tool to Fortune 100 companies operating on around the world. The flagship product PB 7000 Precision Blasting is gaining qualification and acceptance as a repair and maintenance tool in both hand held and robotic implementations. The successful deployment into commercial applications is advancing the system for even more application inside the DoD.

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NAVSEA #2021-0396

Topic # N141-042

Autonomous or Remotely-Operated Maintenance of Ships Tanks
Boston Engineering Corporation

WHO

SYSCOM: NAVSEA

Sponsoring Program: CODE 1223
PNSY

Transition Target: 04T1 – Mr. Rick Anderson

TPOC:
(207) 994-4857

Other transition opportunities:
PMS555 – Mr. Mike McCarraher

Notes: The CLIMBER vehicle is shown transiting through a standard flange opening on Boston Engineering's tank mock-up.



Image Courtesy of Boston Engineering Corporation

WHAT

Operational Need and Improvement: Tank inspection and remediation are critical activities that occur within the maintenance cycle of in-service submarines and surface ships. Rapidly characterizing all conditions within a tank can have a direct impact on the scheduling and costs of shipyard maintenance, which in turn impacts overall vessel operational availability, a critical metric for the US Navy's fleet. Additionally, many ship and submarine tanks include complex, confined, and physically challenging to access regions that stress shipyard personnel and can place them at risk.

Specifications Required: Develop a system that can maneuver from one internal tank bay to another via a standard tank threshold. Ensure sufficient carrying capacity and inspection capability to execute NDT around corners, over tank bays, such that inspection systems can cover 90%+ of the tank spaces. Leverage existing shipyard user interfaces as available and work with existing ship maintenance personnel to ensure applicability to appropriate tanks.

Technology Developed: Boston Engineering has leveraged its extensive experience in ship, hull, and tank crawling robots to enhance inspection capability in a small, back-packable footprint. CLIMBER's advanced platform maneuverability allows for robotic access on all surfaces of a ship's tank and continuous operation from one tank section to another. Combined with a UMAA-compliant software structure, CLIMBER 3rd party sensing tools can be rapidly integrated on CLIMBER's available inspection arm.

Warfighter Value: CLIMBER provides a more ready and available fleet for the Navy through expedited return to service from the shipyards. This is achieved via a more rapid inspection capability, thus decreasing the total amount of time needed for vessel remediation. This decreased inspection and remediation time returns vessels to operation, increasing the US Navy's warfighting posture.

WHEN

Contract Number: N68335-20-C-0044 **Ending on:** October 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial Concept Development and Paper Study	N/A	Mathematical model feasibility analysis	3	January 2019
Demonstration of Vehicle Transit Through Oval Tank Threshold	N/A	Unsupported transit through mock-up threshold	5	May 2021
Arm and Initial Sensor Integration	Low	Sensor data reporting through CLIMBER software to remote user	6	May 2022
Full Tank Section Demonstration	Low	90%+ of tank inspection with remote operator	6	September 2022

HOW

Projected Business Model: Acquisition is planned through combined NAVSEA/Shipyard funding, with the focus of providing trial units to the major public shipyards and regional maintenance centers. Acquisition beyond intermediate NAVSEA/Shipyard funding would occur directly with the shipyards themselves, possibly executed under broader Phase III contract. The team is targeting a product available on FedMall (or similar) by 2023-2024.

Company Objectives: Boston Engineering's objective is to transition CLIMBER to support NAVSEA, the regional maintenance facilities, and both public and private shipyards. More broadly, Boston Engineering's efforts with other robotic and sensing platforms position it to be an industry leader in highly capable, highly maneuverable, in-tank data collection. This technology portfolio has received buy-in from Navy R&D and shipyard operations entities with funding in this subject area. Boston Engineering continues to look for interim funding opportunities, additional sponsors, and teammates, to decrease transition risk and overall barriers for Navy adoption.

Potential Commercial Applications: CLIMBER's remote inspection capability is magnified in value when used in confined spaces, challenging to access environments, or areas where human access is complicated by degassing and/or other operator limitations. While common in Navy vessels, these are also challenges in the commercial shipbuilding, vessel maintenance, oil and gas, and energy industries. Boston Engineering recognizes that as these industries optimize their operations, robotic platforms will become even more commonplace. CLIMBER's unique maneuverability and confined space access capability in combination with sensor modularity provides a valuable system for a suite of operations across the industries listed.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-918

Topic # N192-052

Electrical Load Management System (ELMS)

Cornerstone Research Group, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-275

Transition Target: V-22

TPOC:

301-342-0839

Other transition opportunities: Other military aircraft (e.g. Army Future Vertical Lift and commercial aircraft (e.g. electric vertical take-off and landing and urban air mobility platforms)

Notes: Underlying hardware is already used in other military applications
Future Vertical Lift (FVL)
Electric Vertical Take-Off and Landing (eVTOL)

Urban Air Mobility (UAM)
Common Configuration – Readiness and Modernization (CC-RAM)
Graphical User Interface (GUI)
Naval Air Warfare Center Aircraft Division (NAWCAD)



Image Courtesy of U.S. Navy

WHAT

Operational Need and Improvement: Maximize use of existing power source capacity to support growing power demand

Provide protection to aircraft power distribution wiring

Specifications Required: Monitor power bus quality and excess capacity

Enable smart load shedding and crew alerts

Collect fault data to reduce troubleshooting time

Technology Developed: Replace legacy electromechanical breakers with digitally controlled solid-state devices

Permits a single hardware configuration to address a wide range of aircraft variants

Warfighter Value: Provides significant improvements over baseline electromechanical breakers:

Digital control and programmable trip settings

Real-time load monitoring

Automated load shedding and crew alerts

Diagnostics/fault data for troubleshooting

WHEN

Contract Number: N68335-21-C-0134 **Ending on:** December 2, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I Hardware Feasibility Demonstration	N/A	Demonstrated programmable trip settings	3	January 2020
Phase II GUI and Hardware Demonstration	N/A	Demonstrated GUI for V-22 with functional hardware	4	July 2021
Phase II V-22 Fit Check at NAWCAD Cargo Lab	Low	Demonstrate drop-in replacement	4	January 2022
Phase II Lab Demonstration	Med	Full-power testing in lab environment	4	May 2022

HOW

Projected Business Model: Transition to via CC-RAM through hardware sales to V-22 prime (Bell/Boeing)

Company Objectives: Raise awareness for V-22 ELMS technology within PMA-275 and NAVAIR to identify Phase II.5 and Phase III follow-on funding

Develop relationships with prime contractors for transition to other military aircraft

Potential Commercial Applications: This technology is being commercialized through Lectratek, LLC, a new CRG spinoff providing electric powertrain and propulsion solutions to eVTOL and UAM developers.

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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0507

Topic # N18A-T011

Nondestructive Evaluator for Polymer Ablatives (NEPAL)

Intelligent Automation, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: IWS 3L (Missile Launcher Systems)

Transition Target: Vertical Launcher Systems: Structure and Canister

TPOC:
(540)653-3639

Other transition opportunities: Post production quality check of ablatives inside VLS at Lockheed Martin

Notes: The goal for VLS is to determine the remaining number of launches. LCCP determines when the system has reached end of life. LCCP determines effective life left of plenum & uptake coatings using formulas based on # of shots, based on assumed erosion ratio. The remaining useful ablative thickness measurement is unlike any other type of thickness measurement using ultrasound NDE where the material properties usually remain constant across the thickness.



Photo courtesy of the US Navy

WHAT

Operational Need and Improvement: Missile launch systems integrated with a ship structures, such as the Mk 41 vertical launch system (VLS), need the rocket exhaust to be diverted vertically upwards through the plenum and the uptake. These sections are lined with ablative polymers of varying thicknesses to protect the structure from intense heat from rocket exhaust. The remaining useful life of the ablative panels determines the life of the VLS. Currently, life prediction of these ablative materials is based on pre-determined in lab tests. However, as these multipurpose VLSs launch a variety of increasingly powerful rockets, the predetermined life estimations are inaccurate. A new non-destructive examination (NDE) technique is needed for in situ determination of the remaining useful life of ablative lining.

Specifications Required: The remaining useful life of an ablative depends on the remaining useful thickness of the virgin ablative under the pyrolyzed layers. To measure the virgin ablative thickness requires decoupling of material property variation with thickness from the remaining useful ablative tile thickness. Additionally, there is a requirement of dry contact with the ablative surface as additional moisture/liquid is detrimental to the ablative during missile launch. The goal of NEPAL is life extension based on updated real erosion data.

Technology Developed: IAI has developed NEPAL, a non-destructive evaluator for ablative materials to decouple material property variation with thickness from the remaining useful tile thickness. NEPAL uses unique sensing technique with completely custom and novel dry-coupled dual-mode ultrasonic transduction. We have designed and manufactured unique transducers, material model-based measurement algorithm and C-scan system to perform measurements over an area of ablative tiles. We have developed early prototype system to perform measurement in relevant environment.

Warfighter Value: NEPAL will measure the remaining useful ablative thickness in situ to maximize the life of VLS. The immediate role of the NEPAL tool will be to check the remaining useful ablative thickness at the end of life of each VLS in older ships. The extended role of the NEPAL tool is to update the Launch Control Computer Program (LCCP) calculations with actual ablative thickness measure in-situ at the port in newer ships. Navy will likely use NEPAL tool during a maintenance availability at a shipyard.

WHEN

Contract Number: N68335-20-C-0155 **Ending on:** November 8, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
NEPAL transducer development	Low	Laboratory evaluation of dry coupled ultrasonic sensing	5	September 2021
NEPAL material model development	Low	Material testing, and simulation model	5	September 2021
NEPAL RUT algorithm	Low	Successful estimation of virgin ablative thickness	5	October 2021
Integrated NEPAL system	Low	Successful testing of integrated system at IAI laboratory	5	December 2021
Test and evaluation in relevant environment	Med	Evaluated performance at VLS production facility	6	March 2022

HOW

Projected Business Model: IAI is developing production facilities to produce NEPAL systems and sell them directly to the Navy and through distribution via VLS manufacturers Lockheed Martin.

Company Objectives: IAI is developing customized manufacturing techniques to manufacture NEPAL sensors and semi-autonomous robot for larger scale production. IAI will manufacture NEPAL systems in 25,000 square foot manufacturing facilities. Once the manufacturing processes have been identified, IAI will begin to scale the size of the devices for additional military and commercial applications.

Potential Commercial Applications: Successful technology development will benefit military, commercial customers, and consumers by providing accurate estimation of remaining useful material thickness and remaining missile launches. Additional application of this technology is to estimate remaining metal thickness under coating and corrosion in ships and other structures.

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Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-8742-21

Topic # N192-126

A Chip-based Orbital Angular Momentum Receiver for Underwater Optical Communications

Physical Sciences Inc.

WHO

SYSCOM: ONR

Sponsoring Program: ONR-321

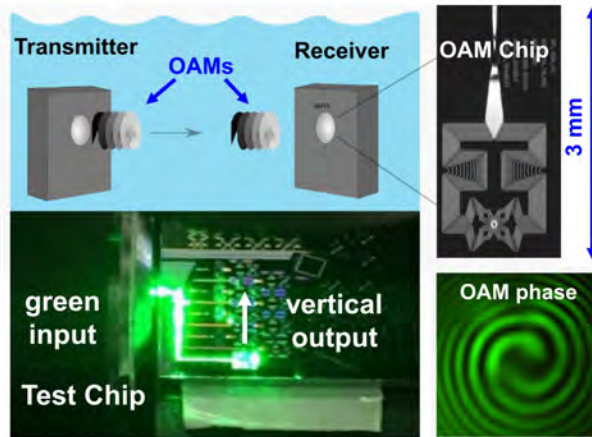
Transition Target: PMS 495, PMS 406, and PMS 408

TPOC:

Dr. Fletcher Blackmon
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Other transition opportunities: Oil and gas industry

Notes: Underwater orbital angular momentum (OAM) transmission uses beams of light with twisted phase fronts that have been shown to transmit through turbid water more efficiently than beams with flat phase (top left). To deploy this technology the Navy requires a low-SWaP approach to transmitting and receiving OAMs. PSI has realized a highly compact chip-based OAM transceiver (top right). We have successfully demonstrated these chips using green light (bottom left) and have shown their ability to generate OAMs (bottom right).



Chip-based OAM Transceiver (Copyright 2021, Physical Sciences, Inc.)

WHAT

Operational Need and Improvement: A high-bandwidth underwater optical link is a critical need for underwater communications. An ideal underwater communications link should be compact and robust, capable of high bandwidths with low error-rates and crosstalk to establish a secure link over long distances. An optical communication system is a highly attractive solution as RF is unable to penetrate water and acoustic systems are low-bandwidth. The large bandwidths and high directionality of laser-based systems are a promising alternative, however, Gaussian beam systems suffer from scattering due to turbidity. Light carrying orbital angular momentum (OAMs) experimentally exhibit higher transmission in simulated turbid water.

- Specifications Required:**
- For 100 m scale operation: bandwidth 10 Mbps
 - For several meter link distance: bandwidth 1 Gbps

- Technology Developed:** A low-SWaP, high-bandwidth optical transceiver
- OAM states increase operational distance and bandwidth through multiplexing
 - Photonic-integrated circuit operating at blue/green wavelengths reduces size
 - Scalable fabrication approach reduces cost

Warfighter Value: A high-bandwidth, long-range underwater communication system is a game-changing capability for the Navy. For example, sensor data collected by a UUV could be quickly and securely transmitted without requiring the UUV to return to a ship or to surface. Such a communication system can be used to remote control UUVs operating in dangerous environment with real-time feedback including video and sensor data. Furthermore, low-SWaP OAM transceivers can be placed on multiple UUVs to enable reconfigurable underwater networks and could also be used to conduct coordinated swarm operations.

WHEN

Contract Number: N68335-21-C-0072 **Ending on:** December 5, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
OAM generation using visible light	N/A	Measurement of phase front using visible light interferometry.	3	2nd QTR FY21
Free-space receiving of OAM states	Low	Transmission of OAM data from a free-space source to the OAM chip with low crosstalk.	3	1st QTR FY22
Operation in a simulated underwater environment	Med	Successful transmission of data over an OAM channel through simulated turbid water.	4	2nd QTR FY22
Packaged OAM transmitter	Low	Develop a fully packaged prototype transmitter head.	4	1st QTR FY23

HOW

Projected Business Model: Physical Sciences Inc. (PSI) plans to create two product variants for initial commercialization. The first product is a green wavelength OAM photonic integrated circuit that would be sold to underwater communications equipment suppliers for integration in their systems. Second, PSI will also directly market its own version of an underwater communication link, including transmitter and receiver terminals with integrated optics, lasers, detectors, and electronics, directly to end users.

Company Objectives: PSI develops advanced technologies and products for the military, aerospace, industrial process, energy, telecommunications, environmental, and medical markets. PSI is strongly committed to developing products based on innovative technologies developed under the SBIR program and has successfully transitioned numerous technologies to support the missions of the Department of Defense, NASA, EPA, and many commercial partners throughout the entire history of the SBIR program.

For this technology, we plan to identify near-term adopters to define CONOPS scenarios and derive technical requirements.

Potential Commercial Applications: Oil and gas companies that perform undersea exploration use UUVs to survey new and current installations. Initially, prototype transceiver systems will be dedicated to military users, but in parallel, we will market early prototypes to oil and gas industry, UUV manufacturers, and undersea-exploration companies.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR

Topic # N08-006

P-8A IAT Fleet Metrics Functionality for Structural Life Management

Technical Data Analysis, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-261 - Health and Usage Monitoring; PMA-275 - V-22 Program; PMA-276

Transition Target: P-8A Poseidon

TPOC:
(301)342-9359

Other transition opportunities: MQ-4C Structural Fatigue Life Tracking (SFLT) program

Notes: Fleet Metrics is an advanced product for Individual Aircraft Tracking (IAT) based data management. Flight Visualization for Fatigue Life Management:

- Illustrates any damaging regimes encountered in flight Mission Planning and Prognostics:
 - Evaluation of past aircraft usage and predicting when maintenance will be needed
 - Evaluate what-if scenarios on future missions and provide detailed information on its effect on maintenance, component replacement times
- Gross Weight/Center-of-Gravity Estimation for Fleet Planning:
- Estimates GW/CG pre- and post-flight. Accepts inputs of multiple aircraft loading configurations and provide new GW and CG for pre-flight planning and post-flight analysis and evaluation
- Post-Flight Analysis Tools:
- View and validate any operational exceedances during the flight. Identify any hard landings and allow the user to evaluate the impact these landings have on aircraft fatigue life.



<https://www.navair.navy.mil/product/P-8A-Poseidon>

WHAT

Operational Need and Improvement: Studies have shown that it is no longer sufficient to simply track the usage and flight hours of each aircraft. Each aircraft is flown in a unique manner. Factors such as gross weight, mission, environment, and even pilot tendencies can make every maneuver more severe or benign than assumed during aircraft design. This leads to a vast majority of aircraft being retired earlier than necessary. Therefore, with an Individual Aircraft Tracking (IAT) system tied into enhanced data management, formerly conservative fatigue retirement times can be more accurately determined, eliminating costly and unnecessary premature aircraft retirement. Similarly, such a system can be used to flag safety issues, tailor maintenance to actual usage, offer design enhancements based on known usage, and provide insight into in-service events (e.g., hard landings requiring inspection or grounding).

Specifications Required: The tool should include the following components: design of an innovative fatigue life tracking algorithm, a novel data management system, and component specific sensor for storing the data. As part of this effort, evaluate current state of the art component sensor technology for applicability in an aircraft environment. Since HUMS systems and capabilities differ between aircraft platforms, the system should have an open, adaptable architecture. The tool should leverage as much actual aircraft usage and load data as possible to minimize conservatism required in the fatigue life determinations, but since data is inevitably lost, gap filling methods should be included. Consideration should also be given to the fact that these components could move between aircraft.

Technology Developed: Fleet Metrics is an advanced product for Individual Aircraft Tracking (IAT) based data management in direct support of PMA-290 and as a future enterprise solution for multiple Naval aviation assets.

Warfighter Value: The successful development of this application leads to establish a fleet-wide IAT based data management tool for all P-8A Poseidon aircraft, based on Fleet Metrics/ACTS, giving data analysis and prognostics capabilities to optimize fatigue life management and enable optimal data storage and data access. Studies by TDA have shown that every 10% of missing or erroneous flight data could lead to a 5% reduction in available aircraft years of service. With aircraft acquisitions costs of approx. \$140M per aircraft, even a 1% increase in data utilization across 50 aircraft would save \$70M.

WHEN

Contract Number: N68335-19-C-0546 **Ending on:** August 5, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop Flight Visualization Demonstration Module for Fatigue Life Management	Low	Successful demonstration with fleet representative data; e.g., P-8A MFDAU	4	August 2021
Develop Mission Planning and Prognostics Demonstration Module	Low	Successful estimation based on extrapolation of in-service fleet structural fatigue life predictions	4	August 2021
Design Gross Weight (GW) and Center of Gravity (CG) Demonstration Module for Fleet Planning	Low	Successful prediction of GW/CG (5% threshold) when compared to measured flight data	5	August 2021
Develop Post-Flight Analysis Demonstration Module	Low	Successful demonstration with fleet representative data; e.g., P-8A MFDAU	6	August 2021

HOW

Projected Business Model: TDA – an engineering and software development consulting firm – provides engineering expertise and customized software solutions in the fields of aeronautical and mechanical engineering, statistical data analysis, web-based business transaction management, and software development. We specialize in combining two distinct fields: engineering and software development.

Upon effective demonstration of this tool for P-8A, TDA intends to extend the tool to other US Navy aircraft designs. TDA will also approach other US military branches (USAF, US Army) as well as aircraft OEMs. Commercialization of the technology is a software product used for aircraft fleet data management. TDA's commercialization strategy beyond DoD will include making key strategic partnerships with OEMs such as Boeing and Northrop Grumman.

Company Objectives: Based on the demonstrated Phase II.5(e) technology development results, additional funding will be sought via a Phase III SBIR for implementation into other new TMS (e.g., MQ-4C). TDA has extensive experience with the P-8A and MQ-4C. Any new TMS under consideration for US Navy adoption has potential to benefit from this technology, given that the earlier in a program applied, the less uncertainty in usage. TDA seeks meetings with persons associated with Primes and Program Offices that would be able to utilize this technology.

Potential Commercial Applications: This software tracking system will have broad application in both the commercial and military industry where life limited components are used.

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Human Systems Projects at NAVSEA and NAVAIR Virtual



Company	Topic #	Project	SYSCOM
Avatar Partners, Inc	N193-D01	On Demand Training Solutions for Maintenance Technicians	NAVAIR
Noise Control Engineering LLC	N172-134	Abrasive Blasting Nozzle Noise Reduction	ONR

Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-868

Topic # N193-D01

On Demand Training Solutions for Maintenance Technicians

Avatar Partners, Inc

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-205

Transition Target: PMA-265, 205

TPOC:

(407)380-4773

Other transition opportunities: As experts leave the workforce due to retirement without replacements, encapsulating expert knowledge via Augmented Reality (AR)/Mixed Reality (MR) training/job-aids offers Department of Defense (DoD) opportunities to address this challenge. AR/MR technologies will help reduce labor burden for limited maintainer resources, enhance knowledge & skills of journeyman maintainers, and improve asset availability & readiness. The following have expressed a need to improve On-Demand Training: Fleet Readiness Centers (FRC), Center for Naval Aviation Technical Training Unit (CNATTU), Naval Sea Systems Command (NAVSEA), Naval Education and Training Command (NETC), Explosive Ordnance Disposal (EOD), Navy Construction Battalions (SeaBees), Naval Special Warfare Command (NSW), and United States Marine Corps (USMC).

Notes: AVATAR is actively pursuing transition of similar solutions to United States Coast Guard (USCG), and United States Air Force (USAF). Transition to USAF is underway through the integration of our immersive content development tools via the USAF's Member, Operations, Training, Analytics Reports (MOTAR) Platform. SIA - The divine personification of perception, in particular the accurate perception which is necessary in order to understand the truth.



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WHAT

Operational Need and Improvement: Frequently, Sailors receive advanced training at the schoolhouse, only to spend years away from the systems they were taught to maintain. Simplified Intelligent AR (SIA) provides immersive AR/MR, On-demand training with built-in performance assessment to minimize skill decay, standardize recurring refresher training at the squadron level, and ensure proficiency for complex, unique, and rarely used tasks.

Specifications Required: Navy seeks enhanced refresher training for aircraft maintenance technicians who have been away from systems for which a Navy Enlisted Classification (NEC) was earned: (1) job-aiding solutions that deliver expert systems advising maintainers on diagnostic and repair procedures in context; (2) a training technology solution leveraging computer-based training, hands-on training opportunities; (3) performance assessment to develop sailor knowledge; and (4) adherence to Risk Managed Framework (RMF) guidelines.

Technology Developed: SIA is an On-demand, AR/MR maintenance training & Job-Aiding platform, built-in performance assessment, advanced training capabilities, RMF design. Dual-mode: Open Space (Off-site) Training Mode: Fully digital depiction of aircraft & procedures; Real Environment (On-site) Execution Mode: Overlays holograms directly onto aircraft via precision model target recognition/tracking, 1/8" overlay accuracy. Advanced AR/MR device features. Integrates A-Measure performance assessment suite.

Warfighter Value: Increases accessibility to training (point-of-need training, solutions for novice to expert), reduces life-cycle sustainment impacts for training content (hardware agnostic, modular design, data-tagging for common training architecture across Type, Model, Series (T/M/S); Reduces time/cost & spare parts needed to troubleshoot/maintain aircraft; Improves training efficiency & knowledge retention; Eliminates errors caused by misinterpretation; Isolation of training and knowledge gaps via data analytics; Reduces on-the-job training hours & time on task; Scalable; Increases Readiness; Organic sustainment of training content.

WHEN

Contract Number: N68335-20-C-0378 **Ending on:** June 25, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Use Case Finalization	N/A	Use Case with direct effect on aircraft readiness	3	July 2020
Knowledge Elicitation; Criticality, Difficulty, Frequency, (CDF) Analysis	Low	End User Organization Selection, CDF Analysis	3	January 2021
System Design	Med	Agile Backlog, Storyboard Creation, Media Capture. Design Documents	4	February 2021
Engineering, Development and Integration	Med	Useable Software Products Delivered. Completion of five (5) major software builds	6	February 2022
Risk Managed Framework Analysis	High	Understanding of current/future RMF Requirements, Integrated into Software/System Design	6	February 2022

HOW

Projected Business Model: Immersive content creators for DoD. SIA developed using simpleAR Pro, our XR development platform that increases efficiency by 10X. SIA sold with unlimited data rights, simpleAR Pro licenses sold to enable DoD to organically update and sustain their own content, eliminating vendor lock. AVATAR can immediately begin full-rate production of SIA upon Phase III award. AVATAR can sell SIA directly to DoD, or white label program allows implementation by original equipment manufacturers (OEMs). 15 Ecosystem Partners Worldwide licensed to sell AVATAR products, including USN SIA. Provide immersive content for entire aircraft, all T/M/S in the Navy, then any type of equipment (aircraft, ships, vehicles, support equipment, etc.), as well as the commercial sector.

Company Objectives: Recognized as industry leader in MR by large businesses such as Microsoft and Unity. Several years ago, AVATAR perfected development of military & industrial-grade MR applications by eliminating jitter, drift, and reliance on markers. Focused on maintenance & sustainment of immersive content through simpleAR Pro, which enables customers to organically update/sustain their own content, without vendor lock. AVATAR will work with the following government organizations for Navy-wide adoption/integration of the SIA MR Platform: Augmented Reality Remote Maintenance Support Services (ARRMSS), a portable AR headset and application that connects distant engineers, in real-time, to troubleshoot maintenance and repair issues; Augmented Reality Community Network (ARCNET) which is establishing AR requirements for NAVAIR.

Potential Commercial Applications: Manufacturing, Oil and Gas, Automotive, Commercial Construction: Building design, metal wall fabrications, building operations & maintenance, Commercial Aviation: Pilot and maintenance training and operations

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Department of the Navy SBIR/STTR Transition Program

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

ONR Approval #43-8805-21

Topic # N172-134

Abrasive Blasting Nozzle Noise Reduction
Noise Control Engineering LLC

WHO

SYSCOM: ONR

Sponsoring Program: Code 34

Transition Target: Navy Shipyards, PEO Ships, PEO Subs, Bureau of Reclamation (hydroelectric plants)

TPOC:

Dr. Kristy Hentchel

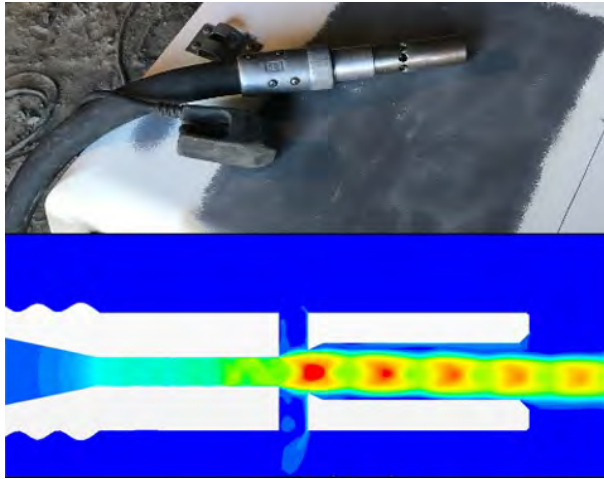
kristy.hentchel@navy.mil

Other transition opportunities:

NAVFAC, Navy Shipyards, Commercial Shipyards, Maintenance Facilities

Notes: Disability claims due to Noise-Induced Hearing Loss (NIHL) and tinnitus are the number one expense of the Veterans Administration. Abrasive blasting operations are widely used in military and commercial maintenance facilities and are extremely loud, increasing the risk of worker NIHL.

Noise Control Engineering has used its extensive acoustic analytical and experimental capabilities to develop abrasive blasting technology that reduces noise while increasing blasting efficiency, thus saving time and lowering worker safety risk.



WHAT

Operational Need and Improvement: Abrasive blasting is an extremely loud and labor-intensive method for removing paint, rust, and other surface coatings and is widely used in the shipbuilding industry and in Navy shipyards and facilities. Abrasive blasting nozzles can generate noise levels as high as 115 dB(A), putting operators and support personnel at risk for short- and long-term hearing damage.

Specifications Required: Technical objectives are to achieve a 20 dB noise reduction and a 20 percent increase in production efficiency (as measured by the particle velocity) as compared to conventional abrasive blasting nozzles

Technology Developed: Advanced modeling techniques coupled with experimentation resulted in an iterative approach to design a more efficient and quieter abrasive blasting nozzles. Prototypes have been developed that have shown reductions in noise levels from abrasive blasting operations as well as an increase in efficiency thus resulting in less time required to complete a task. This results not only in a decreased safety risk for the warfighter or operator, but a cost savings as a result of reduced task time.

Warfighter Value: The potential for excessive noise exposure resulting in Noise Induced Hearing Loss (NIHL) is widespread across many industries and particularly in the military. NIHL reduces warfighter performance, decreases quality of life, increases safety risk and increases cost to the military of a warfighter is no longer fit for duty and retraining is required for them or replacement personnel. Reductions in noise from sandblasting operations will lead to reductions in hearing loss and compensation claims, as well as improved comfort and job retention. An efficiency increase will also substantially reduce the time needed to perform sandblasting operations resulting in large cost savings.

WHEN

Contract Number: N68335-19-C-0072 **Ending on:** April 1, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
PH1B - Test of first noise-reduction nozzle prototype	N/A	Reduced noise and improved efficiency compared to commercial nozzle	4	3rd QTR FY18
PHIIB - Test many families of improved-performance nozzles	N/A	Multiple nozzle families with improved performance	4	1st QTR FY20
PHIIB - Test prototypes with 3D noise-reduction features	N/A	3D features showed reduced noise	4	3rd QTR FY20
PHIIO - Test next iteration of improved performance in refined prototypes	Med	Reduced noise and improved efficiency	5	4th QTR FY21
PHIIO - Prototype test at Navy Facility (PNSY)	High	Subjective performance and ergonomics	6	2nd QTR FY22
PHIIO - Finalize Price Point	High	Competitive part price in current market	6	2nd QTR FY22

HOW

Projected Business Model: Currently there are two business models being considered: 1) Partner with manufacturing company for production of nozzles. Initial production would consist of low number of nozzles for prototype evaluation in government as well as commercial shipyards and facilities before full scale manufacturing. 2) License or sell intellectual property (IP) to a major commercial company already in the business. Preliminary discussions have already taken place with marketing managers from several major companies that supply abrasive blast nozzles.

Company Objectives: Long range objective will depend on choice of business model. If decision was made to keep intellectual property within the company, objective would be to form separate entity for the manufacturing and marketing of the nozzles. If IP were to be sold, objective would be to create a revenue stream through licensing or royalty fees

Potential Commercial Applications: A more efficient and quieter abrasive blasting nozzle has commercial applications across many industries with the marine market being the largest followed by industrial market which include aerospace, metals & mining and oil & gas. Next in potential market size would be automotive and then the construction markets. Abrasive blast nozzles are used extensively in these industries to clean and prepare surfaces for painting, removing paint and rust from surfaces including ships and various metal machinery. The estimated global market is currently estimated to be \$200 million with expected growth rate of about 5% per year.

Contact: Jeffrey M. Komrower, Senior Engineer
jeffk@noise-control.com 978-584-3026

Company	Topic #	Project	SYSCOM
Applied Optimization, Inc.	N181-085	Feed-Forward Controls for Laser Powder Bed Fusion Based Metal Additive Manufacturing	ONR
CFD Research Corporation	N17A-T002	Physics-based Computationally Efficient Spray Combustion Models for LES of Multiphase Reacting Flows	NAVAIR
Creare LLC	N182-103	Carbon Nanotube Windshield Heater	NAVAIR
Hydronalix, Inc	N102-182	MGB II	NAVSEA
MRL Materials Resources LLC	N162-091	Design Tool for Topological Optimization of Air-Platform Structural Components made by Additive Manufacturing	NAVAIR
Pacific Engineering, Inc	N162-079	Advanced composite materials for Energy Regeneration for Improved Vehicle Efficiency	NAVSEA
TrueNano, Inc.	N18A-T004	Hot Filament CVD Technology for disruptive, high throughput SiC epitaxial growth reactors	NAVAIR

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-8820-21

Topic # N181-085

Feed-Forward Controls for Laser Powder Bed Fusion Based Metal Additive Manufacturing Applied Optimization, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: 2019 Quality Made FNC

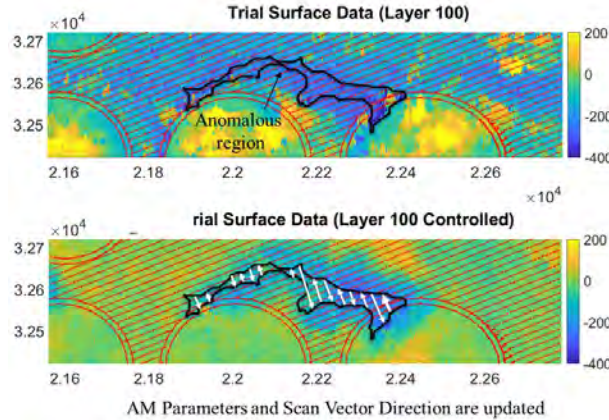
Transition Target: Naval Air Systems Command Additive Manufacturing and Digital Thread

TPOC:

Dr. Ignacio Perez
ignacio.perez1@navy.mil

Other transition opportunities: Aircraft Launch and Recovery Equipment (ALRE), H-1, H-53, LPD 17

Notes: The methods developed in this project allow the layer-by-layer update of the scan path parameters for the purpose of mitigation of build defects. The scan path track vectors are analyzed and corrective measures are applied at locations where build conditions are anomalous. Its purpose is to mitigate defects before they are buried under the deposition of subsequent layers.



AM Parameters and Scan Vector Direction are updated
 Copyright Applied Optimization, Inc. 2021

WHAT

Operational Need and Improvement: To develop feed-forward control (FFC) hardware, algorithms, and multi-physics-based models to allow real-time tracking of powder bed layer variability and corresponding laser processing compensation to improve the quality of laser fusion-based metal additive manufacturing (AM) parts.

Specifications Required: Process the in-situ sensing data to evaluate the potential location of build anomalies, compute and apply the control action to mitigate build defects in near-real time,

Technology Developed: This project demonstrates a prototype of a feed-forward control (FFC) system for the laser powder bed process to produce higher quality AM builds. The FFC is designed to compensate for the systemic variability arising from the statistics of the additive layer, powder bed, and thermal phenomena. The compensation is performed on a full set of laser processing parameters. FFC is implemented as three subsystems to correct for the layer, powder bed, and thermal variability, respectively. The output of FFC for layer and powder bed variability is input for FFC for thermal variability. The disturbance signals are measured using VIS, MWIR sensors and a 3D laser scanner. The sensors are selected to meet the cadence and resolution requirements for FFC, which is performed on a layer-by-layer (L-L), track-by-track (T-T), and point-by-point (P-P) basis.

Warfighter Value: Provides means to produce high-quality as-built AM components using inexpensive, off-the-shelf sensors and guidance from AM process simulations to perform AM parameter compensation and powder bed process control.

WHEN

Contract Number: N68335-19-C-0366 **Ending on:** September 3, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Enable layer-by-layer build plan update	High	Ability to modify and apply the build plan track vectors	4	TBD
Enable compensation of AM process parameters	High	Ability to compute the change in AM process parameters to enhance build quality	4	TBD
Perform feedforward control on a layer-by-layer, track-by-track and point-by-point basis	High	Ongoing	4	TBD

HOW

Projected Business Model: Demonstrate lower cost to produce high-quality as-built AM materials using process control, which is supported by the guidance developed by the AM process simulation. AO will offer software to perform anomaly flagging and process control to perform anomaly correction. The process control includes four critical elements, namely software to predict feature-specific AM process parameters, ability to collect high-resolution, simultaneous VIS and IR in-situ sensing data anywhere on the build plane, ability to modify laser scan path track vectors on a layer-by-layer basis and the ability to specify feature-specific process parameters for anomaly correction. These four technologies are pivotal pieces needed to produce high-quality, as-built material for AM structural parts, which are of great interest across the DoD and industry. AO can offer the technology as a value-add package to original equipment manufacturers of laser powder bed systems.

Company Objectives: Develop AM process simulation procedure and mature it such that the numerical trial-and-error can be used to optimize the AM process parameters at a lesser cost than performing a deposition trial.

Potential Commercial Applications: AM fabrication of critical, structural parts

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NAVAIR Public Release 2021-951

Topic # N17A-T002

Physics-based Computationally Efficient Spray Combustion Models for LES of Multiphase Reacting Flows
CFD Research Corporation

WHO

SYSCOM: NAVAIR

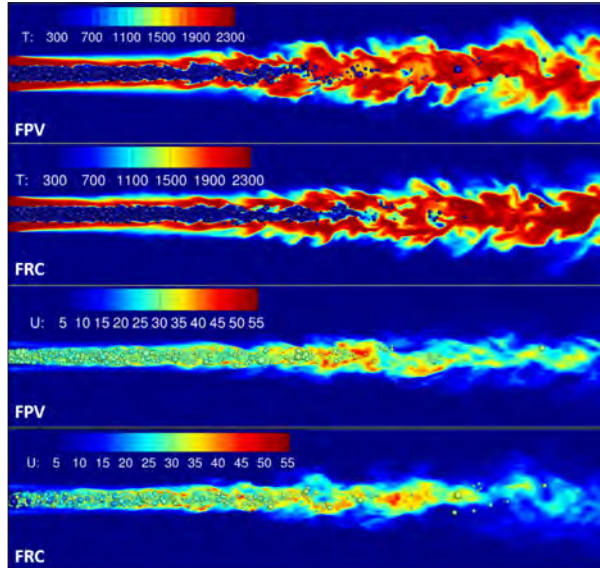
Sponsoring Program: PMA-265

Transition Target:

TPOC:

Other transition opportunities: Navy, Air Force, Army, major aero engine primes including GE Aviation, Pratt & Whitney, Williams International, and Rolls Royce

Notes: Image compares flamelet-progress variable (FPV) and finite rate chemistry (FRC) based simulations of a piloted acetone spray flame experiment



Copyright, 2021, CFD Research Corporation

WHAT

Operational Need and Improvement: Combustion chemistry remains one of the most computationally expensive components of aircraft engine simulations, and real fuel spray-combustion introduces complex physics which can be difficult to model. The Flamelet Progress Variable approach is a well-established method for drastically increasing computational efficiency for gas-phase combustion, and extending the approach to multiphase flow enables these benefits within spray-combustion applications. Flamelet methods have a relatively narrow range of applicability, however this can be alleviated via the Pareto-Efficient Combustion approach which dynamically switches between chemistry models in a way that balances accuracy and cost.

Specifications Required: Investigate and develop a model for spray-flame simulations including effects of multicomponent aviation fuels, preferential evaporation effects, and complex combustor geometries. Verify and validate the computationally efficient spray combustion model using experimental data sets. Demonstrate the model as APIs in reacting flow codes relevant to current and future Navy engine applications of interest.

Technology Developed: The multiphase flamelet approach has been developed as a software API for coupling with CFD solvers, and is demonstrated within a fully coupled density-based compressible flow solver. A standalone software package for generating flamelet tables, for use in both gas-phase and multiphase simulations, has also been developed.

Warfighter Value: Accurate simulations of real fuel spray combustion is crucial for predicting performance, emissions, and stability in gas turbines and augmentors. The accuracy of the spray combustion models used in CFD simulations have a strong impact on the reliability of these predictions, and their computational efficiency is a limiting factor in cost and trade studies. This software tool can speed up computations by orders of magnitude over traditional methods, and incorporates the complex physics determined to play an important role in the targeted applications.

WHEN

Contract Number: N68335-19-C-0177 **Ending on:** March 29, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop gas-phase capabilities	Low	Incorporate flamelet progress variable method into LES solver	2	July 2020
Create models for spray phenomena	Med	Demonstrate analytical models comparable to detailed CFD	2	July 2021
Develop multi-phase capabilities	Med	Couple flamelet method to spray evaporation source terms	3	September 2021
Validate on Canonical Problem	Low	Accurately simulate piloted acetone spray flame	4	December 2021
Option: Validate on Realistic Problem	Med	Accurately simulate swirl-stabilized spray-combustion experiments using aviation fuels	4	July 2021
Option: Integrate API into additional code base	Low	Interface API to Navy-relevant CFD solver, verifying and validating the implementation	5	March 2023

HOW

Projected Business Model: CFD Research Corporation plans to transition this technology to DoD government labs and primes via licensing of our software tools. CFD Research provides also provides on-site software training and consulting services, i.e. using the software to analyze candidate engine configurations and perform parametric studies on behalf of third parties.

Company Objectives: CFD Research Corporation specializes in engineering simulations, advanced prototypes, and innovative designs for aerospace, defense, life sciences, materials, energy, and other industries. Using our software and experimental capabilities, we develop new hardware concepts, innovative designs, and superior solutions for our customers with lower risk, reduced costs, and less time.

Potential Commercial Applications: The models have broad appeal for any spray-combustion applications, including power generation, commercial aircraft, internal combustion engines, and industrial furnaces and boilers. The API can be licensed to private industry and commercial CFD software vendors for integration into their own solvers, and can be tailored for specific applications as needed.

Contact: Timothy Dawson, Senior Research Engineer
tim.dawson@cf-research.com 256-726-4874

WHO

SYSCOM: NAVAIR
Sponsoring Program: PMA-275
Transition Target: V-22

TPOC:
(301)342-0286

Other transition opportunities: Rotary and fixed wing aircraft with laminate plastic windshields including rotorcraft and tilt rotorcraft.

Notes: Broken heaters in aircraft windshields can lead to long down time and significantly increase cost per flight hour. The current heater layer is brittle leading to microcracks and often premature failure. The nanotube-based windshield heater is highly resistant to high repeated strain and will be a robust technology for tilt rotorcraft and rotorcraft windshields.



Boeing (<https://www.boeing.com/defense/v-22-osprey/>)

WHAT

Operational Need and Improvement: Frequent changes in cabin pressure during routine operations cause the plastic windshield to flex causing microcracking of the brittle heating element and failure. Upon failure, the full windshield is replaced. Our drop-in replacement will meet high quality optical standards and heater performance while being repeatably flexed under high strain. An improved robust windshield heater layer will improve the aircraft flight readiness and decrease operating costs.

Specifications Required: Project Requirements: 1. Develop heater layer coating that only has 10% optical transmission loss across the visible and NVIS spectrum while having approx. 10 ohm/sq sheet resistance and low haze (<3%). 2. Drop-in replacement for the current windshield heater. 3. No performance degradation under repeated high strain (500 cycles at 2% strain). 4. High power output of 5 W/in2 using aircraft power supply. 6) High optical and heater uniformity across with full windshield.

Technology Developed: Creare develop technologies for a carbon nanotube based transparent windshield heater for the V-22 tilt rotorcraft. We have demonstrated high optical transparency and low haze in the visible and Night Vision Imaging System (NVIS) spectra, with high power density and mechanical robustness. Subscale coupons are used to develop the heater fabrication process, before adding laminates and scaling up to the full-sized windshield in the Option periods. With our ink development partner, we developed a one pot CNT hybrid ink that is shelf stable, sprays uniformly, results in low haze and low sheet resistance. To enable this size heater and make the transition to large substrates including a full-size V-22 windshield, we developed a completely new Maskless Spray System (MSS). This MSS includes an industrial 6-axis robot, spray head and system enclosure.

Warfighter Value: This technology greatly increases V-22 fleet readiness while decreasing maintenance costs.

WHEN

Contract Number: N68335-20-C-0144 **Ending on:** July 23, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate high optical transparency with low sheet resistance spray coated coupons.	Med	Produced flat and curved 10in square coupons with over 90% optical transparency in the visible and NVIS spectra, low haze and low sheet resistances. We partnered with a leading CNT manufacture to develop hybrid CNT inks for this application.	4	March 2021
Develop a spray system capable of full-size rotor craft and tilt rotor craft windshield heater layers	Low	Assembled and tested our maskless spray system (MSS) including an industrial 6-axis robot and full system enclosure. Completed programming to develop full spray parameters and tooling paths from a complex 3-D shape of a windshield. Fully tested using 10in	4	March 2021
Develop laminate coupons with the equivalent windshield stack layers	Med	Working with our manufacturing partner, we will produce coupon size laminates in flat and curved shapes and test for optical transparency, heater performance, and repeated strain.	4	December 2021
Demonstrate full size tilt rotor craft windshield prototype	Med	Produced a full-size prototype windshield heater layer and laminate to a prototype windshield. We will test the heater performance and optical properties. The prototype will also be available to the Navy for further testing to transition to flight testing	5	August 2022

HOW

Projected Business Model: At the end of the Phase II Options, we will have produced a full-scale prototype windshield for the Navy to evaluate. From that point, we will still need to fabricate and fly pilot production units. For this phase, we will work with a current V-22 windshield manufacturer and Edare, our sister small scale manufacturing company that we are working with during the options to transition this technology. Edare will be able to complete pilot manufacturing of flight capable windshield heaters under a Phase III program while working with a current windshield manufacturer to integrate those heaters into flight qualified windshields.

Company Objectives: Licensing our spray coated nanotube heater technology for high-quality drop-in replacements for rotorcraft and tilt rotorcraft.

Potential Commercial Applications: The commercial applications include windshields in fixed wing applications, automotive windshields and optically transparent covers for lighting, sensors, and imagers.

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0458

Topic # N102-182

MGB II

Hydronalix, Inc

WHO

SYSCOM: NAVSEA

Sponsoring Program:

Transition Target:

TPOC:

(619) 553-8547

Other transition opportunities:



WHAT

Operational Need and Improvement: There is a need for an advanced USV platform to support field operations in the area of Mine Countermeasure (MCM) missions. The main key aspects to address are: increase power development for longer mission duration; advance sensor integration; develop an advance software and hardware package to perform high-level autonomous behaviors; external satellite communications; improve hull design; situational awareness and communications data.

Specifications Required: Further development and demonstration of a new generation Mobile Gateway Buoy Two (MGB2) is required. The MGB2 vessel will be capable of providing external power supply, external satellite communications, along with situational awareness data and communications via command and control console, which can be stationed aboard the AFSB, RHIB, or a remote shore site for the ASW and USW CONOPS.

Technology Developed: Initial test and evaluation prototypes demonstrated to military operators since 2015. The MGB platform is a result of several years of research and development that has led to the development of a high efficiency propulsion design, hull form, and navigation system. Key aspects include acoustic modem integration, high definition cameras, autonomy control and interface software, hybrid propulsion system, and line-of-sight and satellite communication systems.

Warfighter Value: Commander Fifth Fleet forces conduct multiple missions using Navy Expeditionary Unmanned Underwater Vehicles (UUVs), unmanned aerial vehicles and other sensor payloads as part of their Intelligence Preparation of the Environment, mine countermeasures (MCM), lost object localization, and other operations. These forces presently deploy from the Afloat Forward Staging Base (AFSB) on 11-meter rigid hull inflatable boats (RHIBs) that maneuver over the horizon. Present operations require the crews to monitor information from the RHIB using a variety of tools. This manned oversight creates several operational security and force protection concerns for the RHIB crew and other assets in the vicinity. There is also a delay in getting recorded data back from the UUV to the AFSB for review and analysis.

WHEN

Contract Number: N68335-20-C-0624

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Heavy Fuel Propulsion Quieting Design	Med	Functional heavy fuel generator	7	TBD
Autonomous Behavior Development and Integration	N/A	Autonomous capability	6	April 2021
Control Software Integration	N/A	Provides reliable communications link for Command and Control (C2)	6	April 2021
System Fabrication, Assembly, and Verification	N/A	Manufactured hull and integrated components	5	December 2020
Acoustic System Integration	N/A	Has an acoustic range of 1,500 m with the deployable transducer to communicate with the UUVs	6	April 2021
Advance Sensor Development and Integration	N/A	Full sensor integration	6	April 2021

HOW

Projected Business Model: The Mobile Gateway Buoy is expected to transition into full production in support of the Navy Expeditionary UUV program. The Navy Expeditionary UUV is used by Navy EOD and MUSD forces for underwater search and mine counter mine operations. One Mobile Gateway Buoy system is anticipated for each 2-3 Navy Expeditionary UUV units in Navy inventory. The market size is estimated to be approximately \$18-20 million for mine counter mine applications and an additional \$15-\$20 million for other U.S. Navy and commercial applications. Our current production facilities and staff are fully capable for full production of Mobile Gateway Buoy systems.

Company Objectives: Successful transition from high end prototype development to manufacturing of smart USV platforms that can be utilized as a tool by military operators. Program goals include delivery and training to USMC operators and field support in international military exercises.

Potential Commercial Applications: The company is aggressively marketing the base MGB USV platform for other applications separate from serving as a communications acoustic relay node. This includes efforts to sell the platform for use with the U.S. Army Space and Missile Defense Command for Hypersonic Missile testing and with USMC for EOD missions in surf zone. The company has recently completed successful initial tests with an all-electric line of sight operated MGB platform. Fleet operators will test the prototypes developed in this program for their performance, including communications range with underwater platforms, ease of use, reliability, launch and recovery, stealth, and service to keep operating. We anticipate an extensive testing out of San Diego and Norfolk, then follow on mission trials out of NSA Bahrain.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-919

Topic # N162-091

Design Tool for Topological Optimization of Air-Platform Structural Components made by Additive Manufacturing

MRL Materials Resources LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO U&W

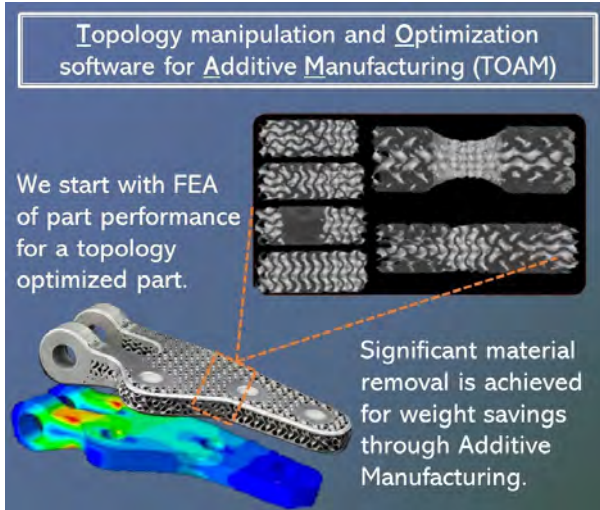
Transition Target: Tomahawk Weapons System

TPOC:

(760)939-5657

Other transition opportunities: MRL's primary transition target is to lead the industry for software used to generate CAD designs for Additive Manufacturing. This technology would enhance the performance of systems requiring lower weight with greater strength such as persistent maritime UAVs or time sensitive strike munitions.

Notes: The ONR Quality Made Current Tech team is exploring the material behavior of topology optimized designs within their modeling tools. Designs can be optimized for material performance and characterization such as light-weighting, where material is removed from the structure, making it lighter without compromising structural integrity.



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WHAT

Operational Need and Improvement: The Navy needs an integrated structural and material design tool that can exploit the benefits of Additive Manufacturing to produce novel designs for future Warcraft (aircraft, ground/amphibious vehicles, and marine) and weapons systems that cannot be fabricated by current methods. Additive Manufacturing has the potential to enhance operational readiness, reduce total ownership cost, and enable parts-on-demand manufacturing.

Specifications Required: The Navy is seeking a design tool to be integrated into existing analysis and design tools with utility for design, fabrication and testing for an air platform prototype component such as a wing or fin.

Technology Developed: MRL has developed both a standalone and server-client computing solution for topology optimization and manipulation for additively manufactured parts. This approach rapidly produces manufacturable, lightweight, strong parts with minimal requirements on user expertise and familiarity with topology optimization.

Warfighter Value: The primary value to the warfighter is greater performance. The warfighter experiences the repercussions of sub-optimally designed parts with heavy, slow, and difficult to maneuver/transport vehicles, equipment, and structures. Our software will allow for a tactical advantage over our adversaries with new designs that leverage the capabilities of additive manufacturing. The ability to achieve the maximum strength and performance possible from currently existing materials with the least amount of material will enhance our strategic abilities. This approach can be used to generate designs for new components but can also be used to replace legacy components to extend the life of aging fleet. Replacement parts could be redesigned and produced on an as-needed basis, thus improving our military readiness and extending the useful life of Warcraft awaiting replacement parts.

WHEN

Contract Number: N68936-18-C-0012 **Ending on:** January 20, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Revamped User Interface for Cloud Use	Low	Full application running on in-house servers for widespread internal use	7	October 2021
In-User Interface for a Finite Element Analysis application	Med	Capability to set up static load cases in MRL's TOAM application precluding the need for additional software	5	November 2021
Tailorable Multi-Objective Optimization within the User Interface	Med	Ability to perform a DoE of parameters within TOAM framework	4-5	December 2021
Rapid generation of new geometries using hardware acceleration for near real-time geometry regeneration and visualization	Low	Time required to generate new geometries should stay under 5 seconds	7	August 2021

HOW

Projected Business Model: Our business model is twofold:

1. Selling software licenses to engineering firms/DoD/etc. that produce CAD models for 3D printing
2. Providing consultant work to produce unique CAD models using our software for companies that can't yet justify the purchase or produce too few models a year which necessitate owning a software dedicated to producing highly complex optimal models.

Company Objectives: Our goal as a company is to solve problems in the additive industry and produce solutions that allow any designer to build high quality parts with model-based qualification to support the use of the parts. MRL's secondary goal is to expand on our consulting capabilities and services to help industry leaders rapidly produce well designed parts made by additive manufacturing.

Potential Commercial Applications: The automotive and medical industries can both benefit greatly from the software MRL is providing. High performance road-going vehicles such as Koenigsegg's CCX and Agera both use 3D printed turbochargers that, with modified topologies, reduce unsprung mass for greater performance. The medical industry uses a number of unique topologies for greater osseointegration. MRL has filed a patent for a particular implementation of our software to generate a new medical implant with improved osseointegration. Any company that specializes in manufacturing high quality implants that maximize osseointegrative qualities would benefit from our software.

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MCSC-PRR-4096

Topic # N162-079

Advanced composite materials for Energy Regeneration for Improved Vehicle Efficiency
Pacific Engineering, Inc

WHO

SYSCOM: MARCOR

Sponsoring Program: PM Ground Based Air Defense

Transition Target: Joint Light Tactical Vehicle (JLTV), Light-Marine Air Defense Integrated System (L-MADIS), Ultra Lightweight Tactical Vehicle (Polaris MRZR)

TPOC:
sbir.admin@usmc.mil

Other transition opportunities: PEI composite technology can be applied to many DoD and Department of Homeland Security (DHS) programs, such as Department of the Army tactical vehicles.

Notes: ATV - All-Terrain Vehicle
GBAD - Ground Based Air Defense
JLTV - Joint Light Tactical Vehicle
L-MADIS - Light-Marine Air Defense Integrated System
Polaris MRZR - MRZR is a designator and not an acronym

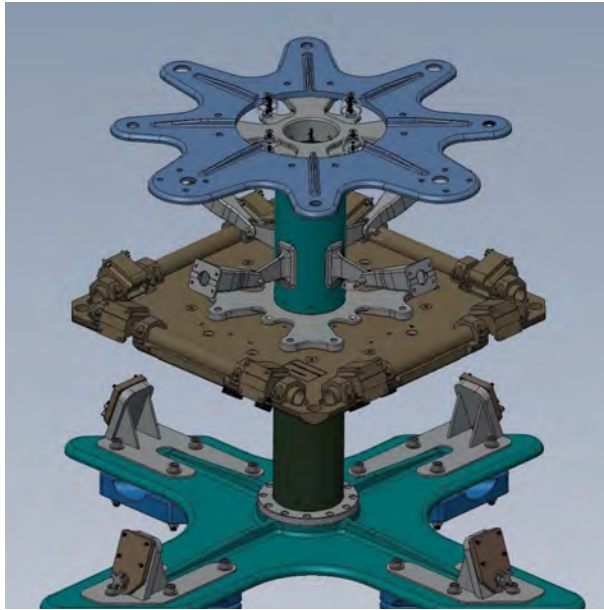


Image courtesy of Pacific Engineering Inc.

WHAT

Operational Need and Improvement: The primary goal of the SBIR Phase II project is to evaluate the Marine Corps Ground Based Air Defense (GBAD) systems to identify components that can be designed and manufactured using composites to reduce weight, lower the system center of gravity, and allow additional payloads to be integrated into the system without overloading the host vehicle.

Specifications Required: Reduce vehicle center of gravity, reduce vehicle weight, and increase vehicle range.

Technology Developed: Composite filament winding for various components using specific resin and fiber selections unique to meet all performance requirements.

Warfighter Value: Preliminary analysis shows a weight reduction by 50%, lowers the center of gravity, and removes the need for preservation due to the implementation of non-corrosive materials. Significant weight reduction from high in the vehicle allows for more payload carrying capability.

WHEN

Contract Number: M67854-20-C-6506 **Ending on:** June 27, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Composite Design and Verification		Lab Tested	4	2nd QTR FY22
Vehicle Integration		GBAD System Integration	5	2nd QTR FY22
Integrated Testing		Engineering Development Model Test	6	2nd QTR FY22

HOW

Projected Business Model: PEI has the in-house capability to build composite shafts, torsion bars, platforms, and enclosures and can transition products to the fleet. PEI will work with prime integrators for insertion of the products into their products which the various programs of record. PEI is working with integrators (now) as the technology is being developed. This approach increases the probability of a smooth transition.

Company Objectives: Find ways to reduce weight, increase range and payload, and lower the platform center of gravity to improve vehicle stability. Additionally, leverage other technology gains to provide an evolutionary approach to improving and introduction of products into the fleet.

Potential Commercial Applications: The commercial applications represent a large market. For example, All-terrain vehicles (ATVs), or commercial equivalent of the JLTV; army larger combat vehicles (like Bradley and its replacement). There is direct application of the roll bar technology for the farming industry.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-852

Topic # N18A-T004

Hot Filament CVD Technology for disruptive, high throughput SiC epitaxial growth reactors

TrueNano, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO(U&W)
PMA-262

Transition Target: NAVY Persistent Maritime Unmanned Aircraft Systems

TPOC:
(301)342-0823

Other transition opportunities: Directed Energy Weapons, Power Electronics & Electromagnetism, Adaptive & Machinery Controls and Advanced Machinery Systems

Notes: Advanced production tools for silicon carbide based power switches will significantly lower their cost and enable rapid deployment of these highly efficient devices in future Navy unmanned aircraft and directed energy weaponry.

TrueNano's SiC Deposition Tool enables cheaper SiC epi-wafers for power switches



Image courtesy of TrueNano Inc. with photos taken from <https://www.navy.mil/Resources/Photo-Gallery/igphoto/2002573557/> and <https://www.navsea.navy.mil/Media/News/SavedNewsModule/Article/6114> leap-nswc-dahlgren-division-developed-navy-shipboard

WHAT

Operational Need and Improvement: The Navy is developing systems requiring high performance, fast switching power switches requiring semiconductors with high mobility, thermal conductivity, high breakdown voltage, and high temperature tolerance. Silicon carbide (SiC) semiconductors meet the requirements: SiC switches operate at voltages 10 times higher than Si-based power devices; operate at temperatures over 350 deg C eliminating the need for thermal management solutions; and operate at higher frequencies, enabling equipment to drastically reduce size, weight, and cost. SiC power switches eliminate up to 90% of power losses occurring in energy conversion processes, imparting significant energy benefits. The challenge is to lower the cost of SiC power switches thus low-cost manufacturing methods of SiC epi-wafers are required.

Specifications Required: A prototype deposition tool that achieves conditions of temperature, flow and pressure enabling rapid growth of 4H-SiC epitaxy, using modeling and simulation as necessary is to be constructed and tested. The process space should quantify the relationship of growth rate, polytype, uniformity, and material quality to the process parameters, like gas flow, substrate temperature, and process pressure. Improve the prototype after testing and demonstrate a path towards scaling to 6". Based on the process, develop a cost model that quantifies epi-wafer and tool costs of ownership.

Technology Developed: TrueNano is developing a SiC epitaxial deposition tool providing low cost-of-ownership, high throughput and is capable of scaling deposition up to 8". These features provide power switch manufacturers with lower cost SiC die, from which the next generation of wide-bandgap, highly efficient power switches and power controllers are fabricated. TrueNano's technology combines traditional gas phase deposition with hot-filament techniques that condition precursor gases, allowing for high growth rates and scalability--key requirements for lowering costs. The technology has been demonstrated and a prototype capable of deposition on state-of-the-art 6" SiC wafers is being developed.

Warfighter Value: The use of silicon carbide based power switches in next generation Navy platforms provides significant advantages over standard silicon based technologies. SiC devices decrease size and weight of systems while boosting efficiency and performance. These advances increase range and payload of electric, unmanned aircraft or improve the lethality and effectiveness of directed energy weapons. TrueNano seeks to accelerate their adoption by lowering the cost of the SiC materials.

WHEN

Contract Number: N68335-20-C-0027 **Ending on:** November 11, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial 4H SiC epitaxial and Reactor Analysis	N/A	Polytype purity, baseline process, filaments survive 100 hours operation	2	October 2018
Cost Model	N/A	Spreadsheet with Inputs and Results	2	August 2019
Reactor Design and Simulation	N/A	Design capable of achieving 1600 C, uniform gas flow profile over substrate	3	May 2020
Full Functionality Testing	N/A	20 minute deposition of SiC using	4	February 2021
Process Optimization	Med	Growth rate vs process parameters and Uniformity Profiles	5	November 2021
Scale Up	Med	Polytype uniformity over 4 inches	6	July 2022

HOW

Projected Business Model: TrueNano intends to commercialize the SiC epi deposition tool using two strategies. In the short term, TrueNano will manufacture these tools in-house, and use them to sell epi-wafers directly to small volume SiC device manufacturers. At the same time, we will pursue licensing opportunities with CVD equipment manufacturers looking to break into the SiC market with differentiated technology. These customers have manufacturing capacity to sell deposition tools to large volume, vertically integrated device manufacturers. Such a partnership will give TrueNano access to manufacturing expertise, while providing to the partner the needed SiC process and technological expertise. The horizon for this plan is estimated to be 2 years, as TrueNano advances the technology past TRL 9.

Company Objectives: TrueNano's goal is to develop a production tool that lowers the cost of semiconductor grade silicon carbide which therefore benefits the entire SiC power device industry. To date, we have demonstrated full functionality of the technology and plan to reach TRL 6 by the end of this project. At the same time TrueNano is actively seeking collaborators and follow-on funding from Navy programs that could benefit from low cost SiC power switches. Outside the DoD, TrueNano has developed relationships with interested strategic partners that are awaiting full maturity of the technology.

Potential Commercial Applications: Within the military applications include high electric demand platforms like unmanned aircraft, electronic attack systems, electric naval ships, high power RF sensors and directed energy weapons. In addition to military applications, the key private sector markets driving demand for SiC are automotive (electric vehicles), power supplies, and applications needing variable frequency drives.

Contact: David C. Bobela, Director of Research and Development
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Company	Topic #	Project	SYSCOM
OptTek Systems, Inc.	N181-031	AEGIS Combat System Optimization through Advanced Modeling of Software-Only Changes	NAVSEA

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0436

Topic # N181-031

AEGIS Combat System Optimization through Advanced Modeling of Software-Only Changes

OptTek Systems, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS 1.0

Transition Target: AEGIS Weapon System's Combat System Test Bed

TPOC:
(202)781-2649

Other transition opportunities: Other PEO IWS combat system development program offices such as the Littoral Combat Ship (LCS) - IWS 8.0, other Navy simulation test beds, or any DoD organizations that use modeling and simulation (M&S) for system design, engineering, and evaluation.

Notes: OptTek's industry-leading simulation optimization software technology integrates with existing simulations to quickly determine the system configurations that produce the best possible outcomes for the system or scenario being simulated. Therefore, it is ideal for M&S environments that are used for system design, tradespace assessments, and test and evaluation. This technology is integrated and verified with multiple DoD simulations and a version of the technology is also already in use commercially.



Missile Defense Agency photo,
<https://www.defense.gov/observe/photo-gallery/igphoto/2002027343/>

WHAT

Operational Need and Improvement: Develop modeling and analysis software to optimize software-only changes in the Anti-Air Warfare (AAW) system design to address Anti-Ship Cruise Missile threats. Tweaks in AEGIS Combat System (ACS) design can provide quick software-only fixes that provide large gains in overall AEGIS performance. Current processes involve human-driven engineering analysis to determine the best options for inserting new upgrades or system improvements; however, this process is manual, labor intensive, and has inputs from disconnected sources slowing the timeline associated with analysis and decisions for software insertions. The Navy seeks to automate current processes and make them more data-driven to field capability more quickly, make the most optimal improvements to AAW within the capabilities of current weapons, and provide integrated data analysis to better integrate and ensure performance of future weapons.

Specifications Required: A software tool that integrates outputs of current and future models and uses goal-seeking behaviors to improve recommendations for software-only optimization of the AAW capability within the ACS. It will integrate with the AEGIS Combat System Test Bed (CSTB) to facilitate system evaluation against more advanced and prolific threats. This tool shall allow for small tweaks to current design parameters so rapid prototyping of AEGIS design and software upgrade recommendations can occur within days (currently takes weeks or months). Design parameters affecting performance metrics should be integrated within the tool to establish a direct link between software design modifications and system performance. The tool will need to run many simultaneous simulations and use that data to recommend optimized changes to software parameters for AAW design to improve performance metrics.

Technology Developed: Developed state-of-the art simulation optimization algorithms and analysis software that integrates with the CSTB to optimize software-only changes in the AAW system.

Warfighter Value: This technology enables computer-aided optimization of AEGIS design and provides better capability from current designs, saving lifecycle costs for AEGIS in the future. This software allows ACS analysts to perform rapid analyses with better performance, design, and verification & validation results enabling the Navy to improve its developmental and operational test & evaluation capability and field new operational capabilities at a pace that counters the advancing technology of adversaries.

WHEN

Contract Number: N68335-19-C-0600 **Ending on:** August 6, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Simulation optimization software integration with Testable Component Environment (TCE)	N/A	Successful test and demonstration with TCE in Navy M&S environment.	5	July 2020
Simulation optimization software integration with CSTB Run Time Infrastructure (RTI)	N/A	Successful test and demonstration with CSTB RTI in Navy M&S environment.	6	June 2021
Simulation optimization software integration with CSTB high-performance computing (HPC) resources	Low	Successful test and demonstration with CSTB HPC in Navy M&S environment.	8	July 2022
Use simulation optimization software to evaluate a Navy-directed operational scenario	Low	Demonstrate optimization with 10 or more systems inputs to improve Anti-Air Warfare system effectiveness by 10% for a specified metric. Decrease time to complete analysis by 20%.	9	March 2023

HOW

Projected Business Model: This technology is a direct development for the Government. As such, OptTek will provide the developed state-of-the art simulation optimization software to the Navy and supporting contractors without licensing costs to include a specifically negotiated license for our OptQuest commercial software, which is our core optimization algorithms technology. Beyond Phase II, OptTek intends to develop new integration software and maintain, support, and enhance the delivered software to support AEGIS and other Navy or contractor modeling and simulation tools.

Company Objectives: Computer simulation models are used widely in the government and private sectors to perform descriptive, diagnostic, and predictive analysis; however, these simulation models are rarely exploited to provide the prescriptive analysis that is possible using our developed technology. Therefore, our Forum for SBIR/STTR Transition (FST) objective is to meet and engage with Navy and prime contractor champions of modeling, simulation, and analysis. Our primary goal more broadly is to improve modeling, simulation, and analysis for government departments and agencies as well as private-sector corporations and companies that use large-scale constructive computer simulation models.

Potential Commercial Applications: In the commercial sphere, modeling and simulation is heavily used by organizations involved in manufacturing, energy, transportation, logistics, and health care. Industries like these could use this technology to find the best ways to configure and employ their existing resources to enhance the performance of their systems, products, and services. Using our developed technology would allow these organizations to get the most out of their current resources without the need for new capital expenditures. This technology is immediately transferable and available through a software license purchase agreement that includes maintenance and support options.

Contact: Shane Hall, Principal Analyst
hall@opttek.com 303-447-3255 x132

Sensors Projects at NAVSEA and NAVAIR Virtual



Company	Topic #	Project	SYSCOM
Innoveering, LLC	AF171-020	Yttria-stabilized Zirconia Environment Sensing (YES) System for Hypersonic Glide Bodies	SSP
Innoveering, LLC	N162-105	Real Time Gas Turbine Engine Particulate Ingestion Sensor for Particle Size and Composition	NAVAIR
Luna Innovations Incorporated	N204-A01	HD Shape Tether for Autonomous Non-Destructive Inspection Tools	ONR
Luna Innovations Incorporated	N19B-T032	Multi-Input Strength Loss Sensors for Webbing Structures	NAVAIR
MSI Transducers Corp.	N182-136	Compact Low Noise Acoustic Sensors for Sonobuoys	ONR
The Probitas Project, Inc.	N191-029	Adaptive Radar Algorithms for Next Generation Surface Search Radar	NAVSEA

Department of the Navy SBIR/STTR Transition Program

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

SSP Approved 11222021

Topic # AF171-020

Ytria-stabilized Zirconia Environment Sensing (YES) System for Hypersonic Glide Bodies
Innoveering, LLC

WHO

SYSCOM: SSP

Sponsoring Program: Strategic Systems Programs (SSP)

Transition Target: US Navy SSP

TPOC:

SSP.SBIR@ssp.navy.mil

Other transition opportunities:

Opportunities exist to transition to DoD and other government customers such as Navy Crane, AFRL WPAFB and other hypersonic wind tunnel operators and to commercial entities such as Lockheed Martin, Pratt-Whitney, Dynetics, General Atomics, Raytheon and GE. The sensor will be available as an integrated unit that in turn can be integrated into a test article. It is anticipated that customization of the sensor and its packaging to address integration requirements will be needed to maximize operational performance.



YES Sensor packaged in standalone probe configuration with size comparison to a US dime. Copyright Innoveering 2021

WHAT

Operational Need and Improvement: The ultra-harsh environments in hypersonic ground and flight testing require the instrumentation and probes to be water cooled and typically require frequent replacement, which can be costly and result in unnecessary facility downtime. In many instances, the probes supporting hardware or cooling designs may impact the actual flow measurement and introduce uncertainty. With the advent of advanced materials and novel thin-film manufacturing techniques, these challenges can be alleviated or even eliminated with the YES sensor technology. Real-time surface temperature and gas composition information can be obtained through the implementation of the YES sensor technology in environments of Mach 5 enthalpy and above, without the need for cooling.

Specifications Required: Miniature in size with ability to be integrated within advanced materials; No active cooling needed to survive extreme temperatures of Mach 5 and above flight environments; Multi-property sensing of temperature, oxygen concentration and pressure; High frequency response to accurately measure the dynamics associated with hypersonic flow time scales.

Technology Developed: A ceramic-based thin film micro-sensor that is capable of operating in extreme temperature environments, typical of hypersonic flight conditions. The sensor can measure directly flow temperature and oxygen concentration in the gas medium, and has a path to pressure measurement as well. It is surface mounted onto a wetted surface or packaged so that it can be integrated into a substrate, like a leading edge or other critical component where temperature and oxygen concentration are needed to be measured.

Warfighter Value: There is no sensor solution that can deliver on multi-property measurement at the ultra-high temperatures servicing hypersonic test articles. The benefits to warfighter are:

- A smaller sensor of < 1/4" outside diameter.
- Reliable operation in harsh hypersonic environments.
- Minimal flow perturbation (flush mounted or integrated).
- Direct temperature oxygen & partial pressure measurements.
- Dynamic data for more accurate hypersonic aero-propulsion performance/drag/thermal loads calculations.
- Sensor to measure skin temperature of a hypersonic air-breathing or boost-glide vehicle

WHEN

Contract Number: N68335-21-C-0070 **Ending on:** October 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Systems / Subsystems Specifications	Low	Submission and Review	3	TBD
Brassboard Systems Assembly and Demonstration	Low	Performance validation near adiabatic CH4/Air flame temperature in the laboratory	3	TBD
Prototype System Assembly and Demonstration	Med	Integrated system demonstration using Innoveering's hypersonic ground test facilities	5	TBD
Carbon-Carbon Composite Implementation	High	Fully integrated sensor node within CCC material and tested in hypersonic ground test facility	5	TBD
Relevant Hypersonic Test Demonstration	Med	Multi-property measurements in dynamic hypersonic flow environment, ground or flight.	6	TBD

HOW

Projected Business Model: Innoveering will scale and manufacture sensors in house and distribute the YES sensors with other sensors through standard aerospace distribution channels. We have personnel experienced in product realization for manufacturing and product commercialization to grow business opportunities. Software and sensor hardware will be produced and sold by Innoveering that can lead to potential DoD program savings if final sensor and hardware requirements and packaging are similar to other applications. Start-up costs, such as tooling and minimum production run needs, can possibly be shared by multiple programs. This not only shares costs, but also reduces program risks for design validation, as well as, ongoing production quality considerations. By identifying additional programs we will improve the likelihood of multiple revenue generation channels. Parallel revenue streams can be realized through sales to combustion and aero-propulsion ground test facilities, as well as other high temperature processing industries.

Company Objectives: We will pursue transition to DoD and other government customers such as Navy Crane, AFRL WPAFB and other hypersonic wind tunnel operators. In all cases we will strive to accomplish both types of Phase II graduation efforts. For non-licensed products that graduate from Phase II, Innoveering will establish a separate entity focused on the specific product family with its own revenue and funding streams. This is necessary to have a production-focused company Vision, Mission & Culture compared to the R&D-focused efforts of Innoveering.

Potential Commercial Applications: Potential harsh and high temperature environments include industrial furnaces, chemical reactors, metals processing, combustion based power plants, internal combustion and jet engines.

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Department of the Navy SBIR/STTR Transition Program

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

Topic # N162-105

Real Time Gas Turbine Engine Particulate Ingestion Sensor for Particle Size and Composition
Innoveering, LLC

WHO

SYSCOM: NAVAIR

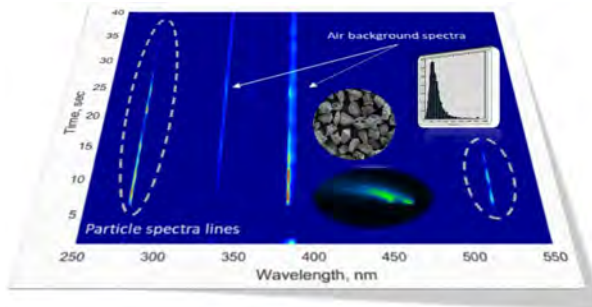
Sponsoring Program: V-22 Osprey, PMA 275

Transition Target: T406 Engine made by Rolls Royce

TPOC:
(301)757-2478

Other transition opportunities: Other aircraft and engines both military and commercial. While the sensor technology is capable of withstanding the severe temperatures and harsh environment inside of the hot section of a turbine engine, sensors also could be placed on other strategic locations of an aircraft. Flight qualification could be simplified for fuselage mounted sensors especially for retrofit applications to existing aircraft. So Program offices that need to improve safety or reduce maintenance costs can more rapidly adopt Innoveering's new particulate sensor if they type qualify the sensor technology in a lower risk mounting location. Program offices could easily bundle the particle sensor with other electronic modules or even weapons systems that they are planning to qualify for flight. Qualification and correlation will be required to establish particle species, and qty of particles encountered in a distal location as compared to that which the engine ingests. However, based on flight conditions this mapping and correlation should be routine and necessary for each new application and aircraft that adopts this technology.

Notes: Innoveering is seeking partners for this application's development engineering stage. Access to maintenance intervals and potential cost savings would benefit the platform ROI calculations and allow the Navy to better field the particulate sensor into the highest priority applications beyond the V22 Osprey.



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WHAT

Operational Need and Improvement: Turbine engines especially on rotor aircraft ingest high levels of dust, sand and ash that harm compressor blades and other critical engine components. This can occur in flight and during landings and takeoffs. The amount or particles and constituent makeup of particles is desired to be understood in real-time so that the pilot can make informed decisions based on these exposures. Also maintenance intervals can be tailored to engine exposure instead of a standard interval that may have little relevance to actual need for maintenance.

Specifications Required: Turbine engine performance and qualification standards.

Technology Developed: A sensor that can detect air born particulates that aircraft are exposed to in flight or during landing. The sensor can determine size, quantity and speciation of select constituent elements of the particles. The sensor can survive high temperatures so it can be mounted in the engine or on exterior aircraft surfaces. The sensor uses a combined electro-optical measurement approach to detect, process and measure particle properties.

Warfighter Value: Pilots immediately know if they have are in a dangerous situation due to engine particle ingestion. It can prevent fatal crashes due to this engine failure condition. Also maintenance of aircraft becomes better to target potential failures before they occur and to reduce costs for unnecessary maintenance if particles have not been ingested at a high rate.

- ✓ Compact, rugged, in-situ sensor system that can be integrated at several places within an engine.
- ✓ System integrates with multiple engines/aircraft with minor modification.
- ✓ System interfaces with an engine and/or aircraft health monitoring computer.
- ✓ Probe does not adversely affect airflow into or inside the engine.
- ✓ Sensitivity and selectivity of measurement to all of the materials of interest.
- ✓ Accurate size and concentration measurement using a localized multi-sensor approach.

WHEN

Contract Number: N68335-18-C-0153 **Ending on:** December 1, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Systems/Subsystems Specifications	N/A	Submission and Review	3	July 2018
Brassboard System Assembly and Demonstration	Low	Species and size measurement in a laboratory environment	4	July 2019
Brassboard System Testing in an Engine Environment	High	Particle size and species concentration measured in an operating gas turbine engine environment	5	October 2020
Prototype System Integrated Testing	Med	Demonstration of integrated operation to detect, process and output engineering values on particle properties.	5	October 2021
Prototype System Operational Testing in Full Scale Engine	High	Real-time engineering value output of particle size, species, and concentration.	6	September 2022

HOW

Projected Business Model: Innoveering will scale and manufacture sensors in house and distribute our line of sensors with other sensors through standard aerospace distribution channels. We have personnel experienced in product realization for manufacturing and product commercial ization to grow business opportunities.

Software and sensor hardware will be produced and sold by Innoveering that can lead to potential DoD program savings if final sensor and hardware requirements and packaging are similar to other applications. Start-up costs, such as tooling and minimum production run needs, can possibly be shared by multiple programs. This not only shares costs, but also reduces program risks for design validation, as well as, ongoing production quality considerations. By identifying additional programs we will improve the likelihood of multiple revenue generation channels. Parallel revenue streams can be realized through sales to combustion and aero-propulsion ground test facilities as well as to ground based turbine cycle power generation facilities and other high temperature processing industries.

Company Objectives: We are seeking DoD, DoS and other government end users of turbine aircraft to endorse and request use of our sensors through their supplybase. We are in contact with engine customers and commercial airlines for commercialization opportunities.

Potential Commercial Applications: Commercial aircraft applications either in engine or fuselage mounted.

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Department of the Navy SBIR/STTR Transition Program

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

ONR Approval #43-8754-21

Topic # N204-A01

HD Shape Tether for Autonomous Non-Destructive Inspection Tools

Luna Innovations Incorporated

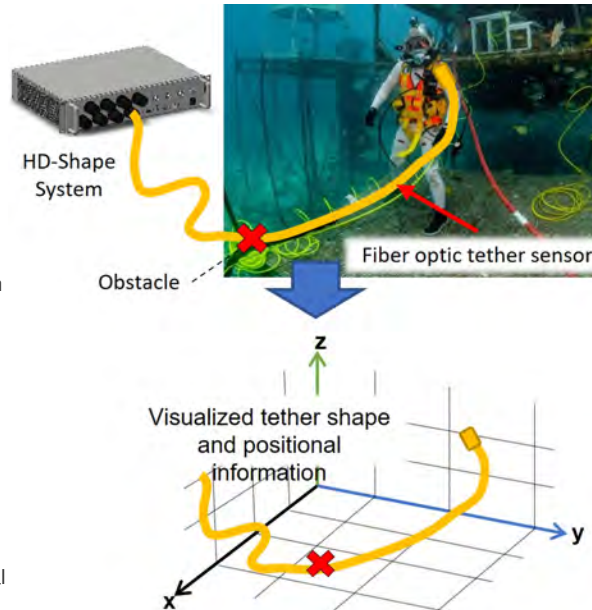
WHO

SYSCOM: ONR
Sponsoring Program:
Transition Target:

TPOC:
 Corey Countryman
corey.countryman@navy.mil

Other transition opportunities:
 Manned and unmanned tethered diving systems; non-destructive inspection tools for piping, pressure vessels, and legacy structures; nuclear power system and spent fuel cask inspections

Notes: The High Definition (HD)-Shape tether is a sensor that provides position and orientation data along its length for non-destructive inspection and diving systems. The tether is designed for integration across multiple inspection and robotic platforms in low-access or GPS-denied applications. It can be leveraged to identify potential obstacles or entanglements on the tether to reduce operational risk to the platforms. An early version of this technology was sold to and commercialized by a medical robotics company.



U.S. Navy image 190610-N-PD526-1003, available at <https://www.navsea.navy.mil/Media/Images/igphoto/2002157860/>

WHAT

Operational Need and Improvement: 3D position and orientation information of personnel, machinery, or equipment typically use a combination of several technologies. Specifically, diving/salvage or robotic inspections have tethers for data transfer and critical support items. A tether capable of inherently providing its position and orientation will improve upon the current systems by enabling an operator to reduce the risk of tangling or becoming encumbered.

Specifications Required:

- A robust fiber optic tether package for integration onto manned/unmanned diving platforms or robotic inspection systems.
- Operation in environments with limited physical access or GPS.
- Sensor tip position and angular accuracy less than 2 ft radius and 6°, respectively, for a 150ft tether.
- An update rate up to 30Hz

Technology Developed: The HD-Shape tether is a low-profile fiber optic sensor that is integrated or attached to a cable that can provide position and orientation data along its length. The tether can provide information to manual or robotic operators for monitoring or smart decision-making capabilities depending on the scenario or application.

Warfighter Value: Readily available positional and orientation data for the warfighter increases effectiveness for diving scenarios. 3D positional data for non-destructive inspections reduces setup time thereby reducing system down-time between missions.

WHEN

Contract Number: N68335-21-C-0236 **Ending on:** February 28, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Proof of concept demonstrated in Phase I	N/A	Prototype sensor operation providing position and orientation along the entire sensor length	3	1st QTR FY21
Stable and accurate sensor measurements	Med	Demonstrate positional measurements less than 0.5% of sensor length	4	4th QTR FY21
Extended sensor length operation	High	Demonstrate shape and positional measurements with errors less than 0.5% per length	5	1st QTR FY22
Demonstration with end users with support	Low	Sensor operation with corresponding integrated equipment for positional feedback	6	2nd QTR FY22
System provided to customer and operated with minimal or no support	Med	Successful use of the sensor in a relevant environment	7	4th QTR FY22

HOW

Projected Business Model: Luna envisions a combination of direct sales and licensing of HD-Shape technology. HD-Shape sensors are well aligned with Luna's current product lines and expertise and provide a pathway to direct sales. Non-destructive inspection groups within power generation industries such as nuclear and petroleum are a method to either license or provide direct sales. Additionally, diving entities may either purchase or license the technology depending on the level of desired integration with existing products.

Company Objectives: Luna seeks to achieving "buy-in" from early adopters in commercial and defense industries. Luna has existing accounts with many prime defense contractors who have had favorable experiences using our distributed sensing products. Luna will work to secure one of these industry players as a Phase III partner to aid in requirements development and testing of HD-Shape technology. Phase III funding will originate from this industry partner combined with funds from government stakeholders that require accurate positioning in enclosed environments.

Potential Commercial Applications: There are numerous commercial applications for HD-Shape technology, especially in areas where tethers or cables are used extensively. Non-destructive inspection systems that use ultrasonic or eddy current techniques use tethers for data transfer and typically have encoder systems for measuring position. By using HD-Shape technology, a user can easily return to the same location for repeat inspections at lower cost, which is a cheaper solution for nuclear power, petroleum, or other process piping industries. A second application is for commercial manned or unmanned diving since tethered communication or air supply is required. Monitoring the tethers and hoses enables the end users to avoid obstacles and reduce the risk of tangling or damage. This technology may also be coupled to augmented reality systems to allow either a diver or a controller to immersively monitor a situation.

Contact: Andrew Boulanger, Research Scientist
boulanger@lunainc.com 540-557-5889

WHO

SYSCOM: NAVAIR

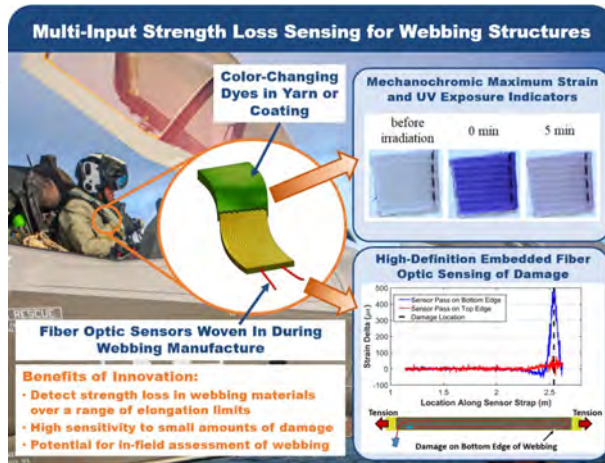
Sponsoring Program: PMA-202, PEO-JSF

Transition Target: F-35, F-18, V-22

TPOC:
(760)382-7321

Other transition opportunities: Torso harness, fall restraints, tethers, parachutes, seat belts, USAF, US Army, US Forest Service

Notes: The accompanying image depicts the smart webbing concept for an ejector seat application. Color-changing dyes and embedded fiber optic sensors are combined to provide a holistic assessment of webbing strength and health. The end goal is to detect percentage loss of strength in webbing structures.



Copyright, 2021, Luna Innovations Incorporated, background photograph U.S. Navy <https://allhands.navy.mil/Media/Gallery/igphoto/2002527709/>

WHAT

Operational Need and Improvement: A non-destructive assessment of webbing strength is not currently available. Webbing is used in military applications to provide safety and load bearing capability with flexible materials. These structures must be periodically replaced due to degradation from wear, UV exposure, temperature, and harsh environments. This is currently performed without feedback data on remaining strength or health of the webbing. Adding a health monitoring capability to webbing structures that can be assessed in the field will increase safety, optimize maintenance, and increase long-term cost effectiveness.

Specifications Required: Detect strength loss of 25% or less
Assess strength loss due to high heat/humidity, UV exposure, chemical exposure, abrasion/wear
Survive harsh environment, flight qualification testing including 810G
Sensing capability must minimize size, weight, power, and not impact pilot operations

Technology Developed: Luna's combination of embedded fiber optic sensors and color-changing dyes will address this technology gap. This low-weight, low-profile sensor integration will add valuable functionality to military webbing structures to enable condition-based assessment of remaining strength. The technology can be used for pilot torso harnesses, tethers, seat belts, and cargo restraints. Coupon tests have successfully demonstrated the fiber optic and sensing dye approaches, which are being refined in Phase II for field deployment.

Warfighter Value: Increase safety, aircraft uptime, mission readiness, and reduce maintenance costs. U.S. Navy fixed wing and rotary wing aircraft subsystems will directly benefit from this innovation. Seat belts, restraint harnesses, fall arrest tethers, and parachute webbings will now have the capability to detect unsafe strength degradation with a technique that can be performed in the field or during depot maintenance.

WHEN

Contract Number: N68936-21-C-0021 **Ending on:** February 1, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Project Kickoff	N/A	Requirements established	4	February 2021
Design and Manufacturing Improvements Complete	Low	Rugged webbing and sensor integration verified	4	February 2022
Prototypes Fabricated for Field Testing	Med	Operational sensors in wearable webbing assemblies, pass 810G tests	5	August 2022
Field Testing	High	Sensors survive harsh environment and verify sensing performance	6	February 2023
Navy Test and Evaluation	Med	Navy performance requirements met	7	February 2024

HOW

Projected Business Model: Luna will partner with OEM manufacturers and prime contractors to bring smart webbing products to market. The patent-pending technology can be licensed or manufactured in-house for new product lines that would be disruptive in the market.

Company Objectives: To enhance the safety, security and connectivity of people by leveraging our expertise in fiber optic-based technology and the information it provides.

Potential Commercial Applications: The ability to detect the silent and invisible degradation of webbing will be a game changing technology that will address military and commercial markets. Beyond military applications, the technology could be adapted to the automotive and heavy equipment industries. Low-cost, low-weight sensors that can be incorporated during manufacturing and then interrogated throughout the webbing's lifetime to monitor structural health is a compelling value proposition with minimal risk associated.

Department of the Navy SBIR/STTR Transition Program

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

ONR Approval #43-8835-21

Topic # N182-136

Compact Low Noise Acoustic Sensors for Sonobuoys

MSI Transducers Corp.

WHO

SYSCOM: ONR

Sponsoring Program: Office of Naval Research

Transition Target: DIFAR AN/SSQ-53 ERAPSCO A-Size Sonobuoy

TPOC:

Mr. Michael Vaccaro
michael.vaccaro@navy.mil

Other transition opportunities:

ERAPSCO A-Size Sonobuoy Current System

FNC ER-DIFAR or VADAR

NAVSEA Volumetric Surveillance Array

Notes: Image of a MSI Transducer with several key Innovations:

- Advanced design of precisely optimized acoustic sensor to increase sensitivity-to-size ratio
- Proprietary PZT injection molding ceramic manufacturing and automated manufacturing techniques facilitating low-cost, high-volume production
- Custom-designed low-noise electronics

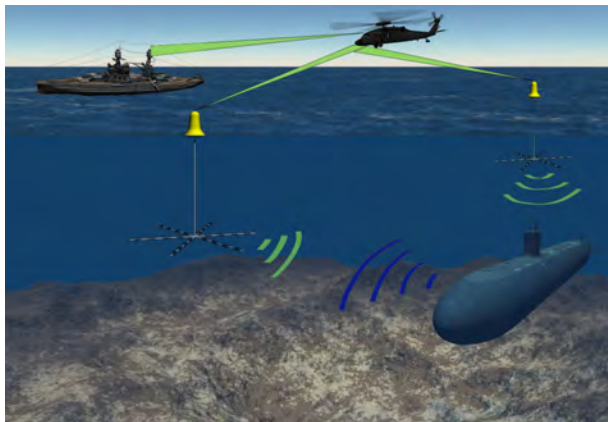


Image courtesy of MSI Transducers

WHAT

Operational Need and Improvement: U.S. Navy sonobuoy is a small, expendable sonar system used by Navy forces to detect and track enemy subs in open ocean and littoral battle space that potentially threaten assets.

The Navy needs a low-noise, sensitive underwater acoustic sensor for use in sonobuoy applications with reduced size to package more sensors into a fixed volume to increase probability of target detection. Navy wants to make use of distributed sensor arrays to increase anti-submarine performance, but needs to increase the density of sensors stored in the sonobuoy to enable this capability.

Specifications Required: Maximum Length: 2.25"

Maximum Diameter: 0.9"

Maximum Noise at 1 kHz: 30 dB

Maximum Noise at 10 kHz: 22 dB

Resonance: >50 kHz

Cost in Production: <\$50/unit for large orders

Technology Developed: MSI's technology enables production of a highly optimized compact acoustic sensor at low-cost. Advanced design of precisely optimized acoustic sensor to increase sensitivity-to-size ratio. Proprietary PZT injection molding manufacturing techniques facilitating low-cost, high-volume production. Bespoke low-noise electronics. Enables application of high-density distributed arrays which augments target detection probability and range.

Warfighter Value: MSI has developed technology that will directly impact the performance of sonobuoys in the naval battle space. The reduction in volume of the acoustic sensor by 48% will nearly double the number of sensors able to fit into a fixed-volume sonobuoy, enabling more robust distributed sensor arrays. This will lead to improved target detection range, resolution, and probability.

WHEN

Contract Number: N68335-20-C-0104 **Ending on:** December 31, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial MSI Sensor Design Concept Validation	Low	Measure ceramic ring based on initial design for key acoustic parameters	3	4th QTR FY20
Navy Verification Testing of MSI Initial Prototype Sensor with Integrated Pre-amp	Low	Build iterated prototype and test it to predicted component performance specification	4	2nd QTR FY21
Navy Validation Testing of MSI EDM Sensor w/ Integrated Pre-amp Manufactured with Low Cost Tooling	Low	Meet sensor level performance specifications	5	1st QTR FY22
Navy Collection of Acoustic Data using Partial 30-element Array of MSI EDM Sensors in Test Sonobuoy Platform	Med	ONR Testing demonstrates subarray performance meets system expectations	6	3rd QTR FY22
Navy Qualification Testing of Volumetric Array with MSI's Sensor on Sonobuoy Platform	Med	ONR Testing demonstrates array performance meets system goals and test successfully in an operational environment	7	1st QTR FY23
NAVAIR Qualification of FNC Sonobuoy	Med	NAVAIR testing and development qualifies new	8	1st QTR FY26

HOW

Projected Business Model: MSI will start commercialization by working with the government and primes to make sure that the sensor meets all the requirements. Sparton and Ultra are currently partners in the Sonobuoy joint venture, ERAPSCO, and are the anticipated customers for the Compact Low Noise Acoustic Sensor. MSI has been in contact with Sparton while writing the Phase II proposal to help guide product development and qualification. As an example, an acoustic and noise test in a Sparton sonobuoy testbed is planned for the Phase II Option. MSI will also engage Ultra during Phase II. Early testing such as this ensures that MSI's product will integrate properly with the sonobuoy system and perform as expected in the fleet.

Company Objectives: MSI Transducers plans to approach Sparton, Ultra, and Triton Systems to provide a lower cost solution with improved performance for existing and new opportunities. MSI is already partnered with Sparton and Triton Systems leveraging this new technological capability and will continue to do so to take advantage of the superior technology demonstrated through this SBIR.

Potential Commercial Applications: Commercial applications are certainly possible as the technology is further developed. This compact, low-cost acoustic sensor is very attractive to commercial customers due to its extremely low price point when compared to similar options on the market. This makes it very attractive especially in Acoustic Communications (ACOMMs) where omnidirectionality is preferred for many applications, especially at low frequencies. MSI will utilize parent company's AIRMAR's worldwide sales and distribution channels that include wholly owned subsidiaries such as Gemeco and Marport in France, Iceland, Norway, Spain and Asia. MSI will determine if there are any ITAR restrictions on this product before starting marketing and sales effort. The low noise hydrophone will either be incorporated into other products such as those for commercial fishing or as stand-alone products. Marport currently has a hydrophone product line that this product naturally fits into.

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Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0354

Topic # N191-029

Adaptive Radar Algorithms for Next Generation Surface Search Radar

The Probitas Project, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: AN/SPS-73(V)18 Next Generation Surface Search Radar (NGSSR)

Transition Target: AN/SPS-73(V)18 NGSSR

TPOC:

(202) 781-2976

Other transition opportunities: Other radar systems that perform Periscope Detection and Discrimination (PDD) including the MH-60R Seahawk's AN/APS-153 Multi-Mode Radar, AN/SPQ-9B Radar, and the AN/SPY-6(V)2 Enterprise Air Surveillance Radar (EASR), as well as other Department of Defense (DoD), Department of Energy (DOE), and Department of Homeland Security (DHS) sensor processing systems that are required to make high-stakes decisions.

Notes: The team at The Probitas Project, Inc. has expertise with Navy Surveillance Radars including the AN/SPS-74 Periscope Detection Radar (PDR), AN/SPS-73(V)18 Next Generation Surface Search Radar (NGSSR), and AN/BPS-17(V)1 Submarine Navigation Radar Management Software.



USS John C. Stennis (CVN 74) operates in the Philippine Sea in February 2016 while deployed to U.S. 7th Fleet. (U.S. Navy/MCSN Cole C. Pielop) [https://www.cpf.navy.mil/news.aspx/110246]

WHAT

Operational Need and Improvement: The AN/SPS-73(V)18 NGSSR is an X-band radar that is being developed to update the current AN/SPS-73(V)12 radar and replace AN/SPS-67(V)3/5 and commercial navigation radars on U.S. Navy Surface Combatant ships. In Standard Tactical Mode, the NGSSR simultaneously performs Navigation, Surface Search, and PDD missions. PDD is a high-stakes decision process where false target declarations are very costly and missed detections are potentially fatal. Current PDD methods require a human operator to aggregate radar classifier predictions with environmental data to achieve acceptable performance. Rapid NGSSR fielding will significantly increase the number of PDD-capable ships, resulting in significant Manpower, Personnel, and Training (MPT) costs required to train and deploy PDD operators.

Specifications Required: The Navy seeks a coherent suite of algorithms suitable for the NGSSR that tangibly enhance radar performance and utility. In this case, "coherent" means that the multiple algorithms are organized and can be integrated to act in conjunction with each other to realize broad areas of performance enhancement in the radar. A set of algorithms that address disparate radar functions piecemeal is not needed. Furthermore, because the radar development program will already be delivering software implementing basic radar functions, such as fundamental search modes and surface contact tracking, they should not be considered in the solution. Algorithms should be designed for modularity to facilitate easy update and compatibility with the existing NGSSR software.

Technology Developed: The Probitas Project, Inc. has developed a fully automatic Target Classifier that combines modern Artificial Intelligence/Machine Learning (AI/ML) technology with enhanced environmental awareness to accurately make high-stakes PDD decisions, removing the need for human oversight and significantly reducing lifecycle MPT costs.

Warfighter Value: Removing the PDD operator will significantly reduce MPT lifecycle costs. Ever-vigilant ML algorithms continuously learn from new data and new environments, allowing the system to keep pace with undersea threats without requiring expensive development, data collection, and test evolutions.

WHEN

Contract Number: N68335-21-C-0135 **Ending on:** November 25, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I: Proof-of-Concept	N/A	AI/ML Target Classifier Performance using Legacy Data Sets	3	January 2020
Phase II: Algorithm Analysis using NGSSR Data (Unclassified)	Low	Completed Data Pipeline	5	December 2021
Phase II: Algorithm Analysis using NGSSR Data (Classified)	Low	Radar Signature Performance Analysis Report	6	September 2022
Phase II Option: NGSSR Comparative Performance Test	Low	Comparable or Better Performance than Baseline NGSSR System	6	June 2023
Phase III: NGSSR Program of Record Integration	Low	Phase III Transition	7	December 2023

HOW

Projected Business Model: The Probitas Project, Inc. is a systems engineering and development company focused on complex sensor and data processing systems. We develop innovative solutions for automated systems providing Detection, Estimation, and Classification capabilities. Our solutions span multiple applications and we have expertise in modern Machine Learning techniques applied to challenging classification processes.

The Probitas Project, Inc. will implement the Target Classifier AI/ML technology in software that we will deliver directly to the U.S. Navy or license to the NGSSR Original Equipment Manufacturer for integration with the NGSSR software baseline.

Company Objectives: The initial transition of this technology is focused on the AN/SPS-73(V)18 NGSSR system, but the AI/ML technology is applicable to a variety of other Navy sensors and data analytics areas. We are establishing a base capability with PEO IWS 2 that can be easily extended to other programs that involve challenging high-stakes decision processes.

Potential Commercial Applications: Our Target Classifier with a modern, data science pipeline provides a robust capability to detect and classify targets embedded in sea clutter. This technology is applicable to DOD, DOE, DHS, and other sensor processing programs that can benefit from an agile solution provider with robust capability across data science, physical science, and sensing domains.

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Company	Topic #	Project	SYSCOM
Intelligent Fusion Technology, Inc	N193-A01	Condition-Based Predictive Maintenance for Mission Critical Systems with Probabilistic Knowledge Graph and Deep Learning	NAVAIR
Luna Innovations Incorporated	N191-015	ACES: Aircrew Endurance System	NAVAIR
Metis Design Corporation	N12A-T007	Ultrasonic Measurement Tools and Models for Gearbox Components – Converted to an SBIR – PII Discretionary for Base Effort	NAVAIR
Mosaic ATM, Inc.	N191-007	Data Analytics Tools for the Automated Logistics Environment (ALE)	NAVAIR
Sharp Vision Software LLC	DHP163-002	Development of Visualization Models and AR/VR Software Tools for Model Based Enterprise	NAVAIR

Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-915

Topic # N193-A01

(3) Condition-Based Predictive Maintenance for Mission Critical Systems with Probabilistic Knowledge Graph and Deep Learning
Intelligent Fusion Technology, Inc

WHO

SYSCOM: NAVAIR

Sponsoring Program: Air Systems Group, Propulsion and Power

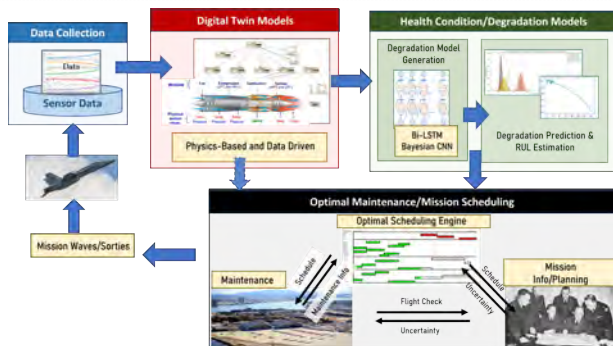
Transition Target: PMA-265

TPOC:

(301)757-2504

Other transition opportunities: Navy programs such as the NAVAIR Air Warfare Center Aircraft Division (NAWCAD) and Naval Surface Warfare Center, Carderock Division-Ship Systems Engineering Station (NSWCCD-SSES). Within the Machinery Control Systems (MCS) & Networks Department in NSWCCD, IFT directly supports the division's objective in their focus areas of MCS, CBM, shipboard instrumentation, sensors, and navigation systems. The second customer segment to pivot would be the Information Operations Science & Technology Battlespace Awareness and Information Operations (PMW-120) NAVWAR.

I-SEER can perform CBPM on any equipment upkeep, e.g. aircraft, vehicles, trains, or construction-based infrastructure, with the condition it has physical sensors and contextual information. Due to the flexible web-based or application service architecture, I-SEER can be deployed anywhere aircraft maintenance is performed such as the Naval Depot-Level, Field-Level, or vendor customer providers, e.g., Lockheed Martin's Sikorsky 360.



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WHAT

Operational Need and Improvement: Modern US Navy surface and aviation systems are designed with an ever-increasing level of automation and advanced machinery that include state-of-the-art sensors that monitor vital aircraft, ship, and auxiliary system functions. The Navy seeks new tools and technologies to augment current onboard condition monitoring and maintenance processes and to improve mission-critical system availability, increase operational readiness, and reduce life cycle costs. These tools must communicate status to the monitoring system, provide options for solutions to machinery alignment, repair, and maintenance, and present the appropriate alarms and information in a manner complementary to the machine intelligence that does not overload the human operator

Specifications Required: Remaining Useful Life (RUL) prediction performance, aircraft availability, and maintenance costs.

Technology Developed: IFT's-Service Enhanced Recommender (I-SEER) is a data analysis and maintenance scheduling web application, that employs deep learning techniques for advanced analytics of onboard sensory data to draw meaningful insights to predict machine states and proactively schedule maintenance by dynamic optimization approach to minimize costs and unplanned downtime.

Warfighter Value: The proposed technology features in the aircraft components health status modeling, degradation modeling, and RUL prediction, which benefits the condition based predictive maintenance and further reduce the costs of routine maintenance and unit failure. Further, the proposed technology performs optimal maintenance and mission scheduling, which minimizes the maintenance costs and improves the efficiency of the repair personnel and aircraft fleet readiness.

WHEN

Contract Number: N68335-20-F-0562 **Ending on:** November 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Concept Design	N/A	Design Documentation	TRL 2	April 2020
Develop and evaluate full-scope prototype in simulated environment	Low	Performance evaluation of real time I-SEER prediction and Optimization	TRL 5	November 2021
Field test prototype on Navy platform in an operational scenario	Med	Performance requirements met in an operational scenario	TRL 6	August 2022
Transition technology into PMA-256 program and/or integrate with commercial platform	Med	Operational requirements met in a developmental test platform or equivalent real world system	TRL 7	April 2023

HOW

Projected Business Model: Intelligent Fusion Technology has over 10 years of steady growth providing innovative, cost-effective solutions through R&D. Over 50 IFT projects have produced a wealth of advanced-technology prototype software that can facilitate the rapid integration of critical technology into operational systems. IFT will license the I-SEER technology to large system integrators and integrate it into Navy platforms, such as PMA-265 and PMW-120. Once integrated, IFT will provide users with full documentation on how to use the features of I-SEER.

Company Objectives: Condition-based predictive maintenance, digital twin, and AI/machine learning are core business areas for IFT, making the success of this effort fall squarely within our corporate interests and competencies. IFT expertise will ensure the success of the innovations developed under the I-SEER program beyond the SBIR contract. In particular, IFT plans to pursue a multi-part plan to transition this technology to the U.S. Navy and other U.S. Government customers, as well as provide benefits to commercial markets and customers seeking to improve the operational readiness of equipment maintenance systems and increase up-time during critical operating conditions.

Potential Commercial Applications: We expect the full-scope I-SEER to have immediate and tangible benefits for a number of commercial systems that require regular maintenance and repair, such as the automotive, transportation, and biomedical sectors. We will develop a broad commercial product for diagnostics and prognostics of industrial machinery systems.

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NAVAIR Public Release 2021-889

Topic # N191-015

ACES: Aircrew Endurance System

Luna Innovations Incorporated

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA202
Aircrew Systems

Transition Target: PMA202: Personal Protection and Performance, Combat Survivability & Perseverance

TPOC:
(301)342-3988

Other transition opportunities: Navy Medical Logistics Command, PEO Soldier

Notes: Luna's musculoskeletal support system counteracts loads from body-worn masses (e.g., helmet, night vision goggles) and stabilizes the core to reduce fatigue and pain from vibrational loading in the aircraft. The system is low profile, low weight (approximately 1 pound), and is designed to be worn under the flight vest while still allowing access to the dials for adjustability.

When worn, flight crew will have reduced musculoskeletal loading but will still have fully mobility with no impact on egress from the aircraft. Multiple completed systems have been produced with a manufacturing partner, and Luna aims to find a transition partner to complete in-flight testing.



Image provided by Luna Innovations

WHAT

Operational Need and Improvement: Reduce fatigue and musculoskeletal pain (e.g., low back, neck, core) associated with long duration flights while increasing flight crew readiness, situational awareness, and performance.

Specifications Required: Technologies must be compatible with current naval aviation aircraft platforms. Solutions must demonstrate a reduction in pain experienced during/after flight.

Technology Developed: Luna has developed a low-profile, wearable support system to mitigate fatigue and musculoskeletal pain. The system's dual approach counteracts loading from body-worn masses by off-loading muscles in parallel with the spine (back tension element reduces the muscle force required to maintain a posture) and stabilizes the core (adjustable, inflatable lumbar support) to maintain proper posture and reduce fatigue and pain from vibrational loads in the aircraft. The system is adjustable for use over a range of aircrew body sizes and conditions, accessible under the flight vest, and can be used across multiple platforms. Weighing approximately one pound, the soft, wearable system does not add bulk and will not restrict mobility or the ability to egress the aircraft.

Warfighter Value: Luna's system mitigates the effects of the rotary environment (body worn masses, vibrational loading, suboptimal posture) that may lead to fatigue and pain with no added burden to the flight crews (low-weight, comfortable, adjustable). By counteracting the added weight from body-worn masses (e.g., helmet, night vision goggles) and stabilizing the core, Luna's wearable system reduces musculoskeletal loading for flight crew. Reduced loading reduces fatigue and pain associated with long duration flights, and enables flight crew to maintain peak performance and increased situational awareness for the complete mission duration. Mitigating fatigue is also expected to increase flight crew readiness through a reduction in lost workdays and related medical costs from musculoskeletal injury and pain.

WHEN

Contract Number: N68335-20-C-1007 **Ending on:** September 29, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Production of functional prototype	Low	Demonstrate technical feasibility	TRL 3	November 2019
Demonstrate reduction in loading with computational model	Low	Demonstrate efficacy of system in reducing musculoskeletal loading	TRL 4	June 2021
Pilot-scale production of advanced prototype with manufacturing partner	Low	Demonstrate ability to scale production	TRL 5	January 2022
[If Option Awarded] Perform lab-based evaluations to quantify performance gains	Med	Validate function in simulated operational environment	TRL 6	March 2023

HOW

Projected Business Model: This technology will be sold directly by Luna and manufactured by partners at Capewell Aerial Systems. Capewell is a respected provider of engineered products for aerial delivery, life support, and tactical gear for the military. Capewell is currently capable of pilot-scale manufacturing and could transition to full rate production within six months. Luna currently sells a line of medical simulation products in collaboration with Capewell.

Company Objectives: Luna is looking for partners to assist with the completion of qualification/airworthiness testing (as required) and for evaluation of the wearable system with in-flight testing. This technology is a growth opportunity as Luna aims to expand our product offerings in the biomedical space and to continue development of human performance and human interfacing technologies. Luna develops cutting-edge, disruptive technologies through highly leverageable Research and Development (R&D) grants and contracts. Technology commercialization is addressed through a disciplined and integrated business model designed to accelerate the process of bringing innovative solutions to market. This model has resulted in revenue of approximately \$80M per year.

Potential Commercial Applications: Though specifically designed for military aircrew, Luna's wearable system could help reduce musculoskeletal pain and fatigue associated with other commercial sectors, such as commercial pilots, long-haul truckers, construction workers, and office workers.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2021-861

Topic # N12A-T007

Ultrasonic Measurement Tools and Models for Gearbox Components - Converted to an SBIR - PII Discretionary for Base Effort

Metis Design Corporation

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-299

Transition Target: H-60 Seahawk

TPOC:
(301)995-4147

Other transition opportunities: CH-53E, CH-53K, H-1, V-22

Notes: Sensors primary use is for preload verification of the inboard retention plate of the TGB after a maintenance event to eliminate manual torque verification checks that require disassembly of the rotor head. Sensor will assess structural integrity of the spline in combination with preload verification. The novel hardware & sensor integrates within the tail gearbox such that it can be ultrasonically inspected without disassembly. The embedded piezoelectric array maps changes to torque down to individual bolts and integrity down to the location on the spline tooth.

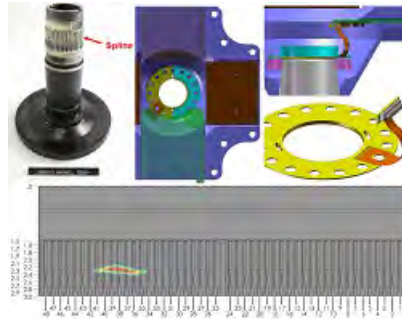


Image courtesy of Metis Design Corporation

WHAT

Operational Need and Improvement: The Navy has a need for fully-integrated and automated approaches to accurate non-destructive assessment of structural health for rotorcraft gearboxes. Current inspection practices can require significant down-time, breaking of factory seals, specialized equipment and trained personnel to evaluate structural integrity, and is prone to operator error. Structural health monitoring (SHM) sensors and hardware are permanently integrated into an asset to provide real-time detection capabilities without disassembly.

Specifications Required: SHM systems need to maintain as good or better damage detection capabilities as current baseline practices, described by probability of detection (POD). Further, as SHM systems are permanently integrated, they must endure the environmental and loading requirements of the target platform.

Technology Developed: Piezoelectric (PZT) beamforming sensors are incorporated into the gearbox assembly, fully-integrated with all necessary hardware to facilitate testing. Power and data are transferred wirelessly through the tail rotor, eliminating the need for connectors or complex wiring. The system can resolve crack initiation to individual spline elements and indicate bolt-torque while the vehicle is at rest on the ground.

Warfighter Value: Structural health monitoring (SHM) provides reliable mapping of damage within structural components without manual tear-down inspection. This approach increases asset readiness and reliability, while reducing costs associated with preventative maintenance and inspection.

WHEN

Contract Number: N68335-20-C-0858 **Ending on:** January 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Bolt-Torque Prediction Characterization	Med	Demonstrate ability to reliably measure torque +/-5%	5	August 2021
Fatigue Crack Prediction Characterization	Med	Demonstrate ability to reliably detect 0.050" crack	5	September 2021
Full-scale Hardware Production	Med	Fabrication of proposed production hardware	5	December 2021
CIVA Model Validation	Med	Good comparison of model data to demonstrated results	5	December 2021

HOW

Projected Business Model: Presently Metis Design Corporation (MDC) sells hardware components directly through a low rate initial production (LRIP) partner. Once demand suffices, the system design and intellectual property (IP) would be licensed to an appropriate Tier II integrator to provide the hardware, installation and support. Funds would be derived through royalties, system customization and future upgrades.

Company Objectives: The company is looking for lead customers willing to facilitate advanced development testing through higher TRL, Tier I OEM customers as well as Tier II licensing partners.

Potential Commercial Applications: The demonstrated technology is suited towards fault detection for any rotating equipment. The SBIR focused on the tail gear box for MH-60 R/S Seahawk, but the system would provide benefits for any type of gearbox for any rotorcraft.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-955

Topic # N191-007

Data Analytics Tools for the Automated Logistics Environment (ALE)

Mosaic ATM, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-231

Transition Target: E-2D Hawkeye

TPOC:

(301) 757-7226

Other transition opportunities: The DoD needs the highest quality maintenance data to improve maintenance, logistics, and training efficiencies. There is an increasing opportunity to leverage artificial intelligence (AI) and machine learning (ML) for aircraft sustainment. Therefore, potential for commercialization of this technology throughout DoD is significant and we are actively pursuing solicitations supporting NAVAIR, NAVSEA, Air Force Software Maintenance Squadrons, and the Joint AI Center (JAIC). Similar solutions are being built for commercial airlines, transportation operators, construction, energy, and the rapidly growing unmanned aircraft system (UAS) industry.

Notes: Mosaic reduced risk in Phase I by focusing on developing proof-of-concept algorithms to deploy in an early prototype to evaluate integration, performance, and visualizations. The Automated Logistics Environment (ALE) Analytics Application (ALE AA) showcases Mosaic's data science expertise using extremely large volumes of data found in E-2D ALE flight packets. Mosaic's software mined hundreds of thousands of lines of advisories, cautions, warnings (ACAWS) data and built-in-test (BIT) failures to provide extremely useful descriptive analytic visualizations. The data pipeline created provides a foundation for continuous modeling with advanced data science techniques.

*Image: Iwakuni, Japan (Feb. 2, 2017) Five U.S. Navy E-2D Hawkeyes with Carrier Airborne Early Warning Squadron 125, land at MCAS Iwakuni. (USMC photo by Lance Cpl. Jacob A. Farbo)



<https://www.flickr.com/photos/mcasiwakuni/32283181790/>

WHAT

Operational Need and Improvement: The vast amount of data collected by US weapons systems presents a great opportunity to improve readiness. Applying advanced analytics to aviation sustainment enables machine learning (ML) for predictive maintenance to improve mission capability rates. Development focused on forecasting weapon replaceable assembly (WRA) and circuit card assembly (CCA) failures could facilitate improved data-driven decision support tools and lead to efficient supply chain management (SCM) and higher fleet readiness.

Specifications Required: The government customer desires a prototype software toolset capable of machine learning, data mining, and identifying trends to improve maintenance procedures and readiness. The solution must be web-based or a closed loop effort as information technology framework, methodologies, and technologies determine the sustainment barriers once fielded. It must adhere to agnostic, non-proprietary, interoperable and best industry development processes as this will ensure seamless integration of the toolset.

Technology Developed: Mosaic ATM has designed and developed a cloud-based, advanced analytics computing platform to improve fleet readiness. The platform ingests data from various sources, reduces the data for quicker processing, and offers virtual machines for hosting advanced artificial intelligence (AI) and machine learning (ML) algorithms. Specific applications to-date include a predictive maintenance model for the E-2D Advanced Hawkeye, exploiting Maintenance Action Form (MAF) data and Advisory, Caution, and Warning system (ACAWS) data collected by the E-2D's Automated Logistics Environment (ALE). The model is a deep learning neural network that forecasts weapon replaceable assembly (WRA) and circuit card assembly (CCA) failures to inform and guide aircraft maintenance and logistics.

Warfighter Value: Mosaic's advanced analytics platform has the potential to revolutionize aircraft readiness. Leveraging existing large data sets, improvements in processing, and high-confidence machine learning techniques, Mosaic has been able to quickly develop and deploy predictive maintenance algorithms in a continuous integration / continuous deployment (CI/CD) environment. These data stream analytics enable operators to efficiently manage critical aviation supplies and perform maintenance to optimize aircraft mission capability rates in a resource constrained environment.

WHEN

Contract Number: N68335-20-C-0808 **Ending on:** September 22, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Base: MS1 - Access to Comprehensive E-2D Data Archive	Low	Secure access to flight packet data	3	January 2021
Base: MS2 - Develop ALE AA Beta	Low	ALE AA Beta demonstration	4	September 2021
Base: MS3 - Deploy ALE AA Beta in Test Environment	Low	Successful deployment in test environment	6	March 2022
Base: MS4 - Access to Navy Software for Deployment in Live Environment	Low	Secure access to live deployment environ	7	September 2022
Option: MS5 - Develop ALE AA 1.x	Med	ALE AA 1.x demonstration	8	December 2022
Option: MS6 - Deploy ALE AA 1.x in Live Environment	Med	Successful deployment in live environment	8	January 2023

HOW

Projected Business Model: Mosaic is leveraging existing data collection by ALE to focus on developing algorithms to assist technicians in performing maintenance before malfunctions occur. We are actively pursuing opportunities to deploy those algorithms throughout the Naval Aviation Enterprise as well as commercial aviation. We are leveraging existing consulting services to Fortune 100 companies in predictive analytics and machine learning for many of these vertical market segments. The addressable market is in excess of \$15 million in license fees and sales.

Additional investment required to bring this technology to market will be funded internally by Mosaic. We have made a significant initial investment and have sound financial operations to ensure the viability and opportunity for the proposed technology to be pursued through commercialization. Over the next three years, Mosaic has a budget of over \$500,000 of internal funding to support the commercialization of technology such as will be produced in this Phase II.

Company Objectives: This project is focusing heavily on developing predictive maintenance micro services using maintenance action forms (MAF) from the Naval Aviation Logistics Command Operating Maintenance Information System (NALCOMIS) and in-flight performance monitoring data from the E-2D Hawkeye. We intend to take a similar approach with other Naval aircraft. We will use MAF data from NALCOMIS as the foundation for development and then seek to ingest in-flight performance monitoring data from other Naval Aviation aircraft.

The ultimate goal is to deploy explainable advanced analytic tools throughout the Naval Aviation Enterprise to optimize fleet readiness. We anticipate additional Navy opportunities include the FA-18 Super Hornet, EA-18 Growler, P-8 Poseidon, MQ-4C Triton, MQ-25 Stingray, and SH-60 Seahawk.

Potential Commercial Applications: Outside of the DoD, we are already marketing a similar approach with our existing commercial air carrier customers.

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Department of the Navy SBIR/STTR Transition Program

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NAVAIR Public Release 2021-858

Topic # DHP163-002

Development of Visualization Models and AR/VR Software Tools for Model Based Enterprise
Sharp Vision Software LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: COMFRC
Advanced Technology & Innovation IPT

Transition Target: Navy Product Lifecycle Management (N-PLM), NAVAIR Digital Office

TPOC:

Other transition opportunities: DoD

- Maintenance Organizations
- Fleet Readiness Centers
- Naval Shipyards and Regional Maintenance Centers
- Marine Corps Logistics Commands
- Naval Information and Warfare Centers,
- Air Force Logistics and Maintenance Centers
- DoD Original Equipment Manufacturers and sub-tier suppliers

Notes: SVS software product, AVARIS, provides DoD organizations with the ability to generate authoritative digital work instructions and training materials for use in a connected digital environment. This moves DoD beyond paper-based work instruction with text and 2D graphics, and allows rapid development of technical instructions with visually representative 3D models and other embedded digital content, including videos, audio, photo and text, that improves understanding of complex concepts and maintenance processes.



WHAT

Operational Need and Improvement: The Navy is currently transitioning from a paper-based work environment to a connected digital environment by upgrading industrial facilities with robust information technology and deploying enterprise Product Lifecycle Management (PLM) software to store and distribute digital data and manage workflows. To further use this investment, operational measures must be taken to improve the way technical information is organically developed and used by Navy personnel who provide maintenance, repair, overhaul and sustainment support.

Specifications Required: Developed to meet the desired objectives :

- create step by step work instructions or training materials augmented with imbedded digital content (Animations, 3D Models, Video, Audio, photos, text) and view on a variety of IT peripherals (PC, mobile devices, headsets)
- convert existing PDF instructions into digital work instructions format for editing and viewing
- ID and incorporate solutions to rapidly create 3D content with portable hand held scanning technology and decimate large 3D CAD Files and Laser scan point clouds
- operate as either standalone package, or integrate with enterprise Product Lifecycle Management (PLM) software suite

Technology Developed: Developed using proven industry standard software stack and state of the art hardware solutions:

- Custom work instruction editor built on the MERN Stack (Mongo DB, Express and React, Node.js), Model Decimation powered by Pixyz and viewer app built using Unity 3D
- Matter and Form 3D desktop scanner for small objects; Peel 2 handheld 3D scanner for larger items which captures color and texture

Warfighter Value: Provides the DoD Sustainment enterprise with the opportunity to generate work instruction and training materials with 3D content and other digital artifacts to visualize complex maintenance tasks that allow for better understanding and task execution, which improves safety, performance and quality. Leverages existing DoD Model Based capability capital investments and facility modernization by extending transformation to the way the sustainment community develops and communicates technically complex information.

WHEN

Contract Number: N68335-19-C-0533 **Ending on:** March 11, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
UX/UI improvements	Low	Usability and Aesthetics	8	July 2021
AVARIS Version I Release	Low	User Functionality, speed of model decimation	8	August 2021
Documentation/Bug Fixes	Low	User Manuals, expanded evaluation testing	8	February 2022
Production Deployment	Low	Hololens viewer Port, Software refinement, On site training	9	March 2022

HOW

Projected Business Model: Sharp Vision Software's business model for AVARIS software will be similar to software licensing approaches based on customer requirements.

- A subscription model (# licenses to support concurrent users within the enterprise)
- One-time upfront license fee with annual recurring maintenance fees

Company Objectives: For Dept of Navy and other DoD Customers: SVS's objective is to license the AVARIS Software package and pursue integration with Navy's Product Lifecycle Management (PLM) deployment with Siemens' Teamcenter or any other PLM tools being planned.

For Commercial Sales: Planned Software licensing strategies to provide same capabilities with scalable standalone packages to support small -mid- large size engineering and manufacturing firms.

Potential Commercial Applications: SVS' AVARIS can help commercial industries with similar requirements migrate from a 2D paper-based environment to a 3D model-based environment to increase productivity and reduce costs. Commercial applications include general aviation manufacturers and repair facilities; shipbuilding and maintenance; automotive industry; energy, medical equipment, etc. This technology solution targets industries with complex assemblies and production processes.

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