

Department of the Navy SBIR/STTR Transition Program

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Topic # N143-127

Electrically Functional Garment Systems: Developing a Smart Integrated Uniform™

Prototype Garment

Propel LLC

WHO

SYSCOM: NAVSUP

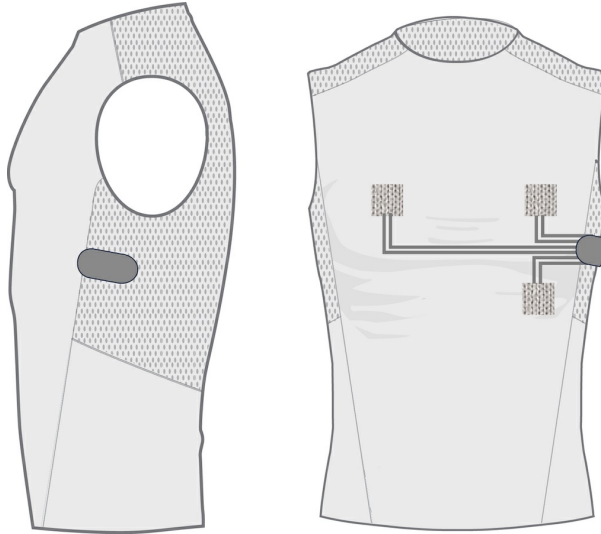
Sponsoring Program: Naval Surface Warfare Center Carderock Division Disruptive Technologies Lab Code 00T

Transition Target: United States Navy Special Warfare Command SEAL Delivery Vehicle

TPOC:
(508)233-1340

Other transition opportunities: US Army PM Air Warrior, US SOCOM TALOS program, Defense Health Agency, US Army Integrated Soldier Sensor System. Other DOD applications that can benefit from scalable distribution of sensors over a broad surface area. These applications include, but are not limited to, human, structure, asset and environmental monitoring, antennas, heating and lighting.

Notes: Illustration shows the 3D knitted Smart Integrated Uniform™ (SIU) physiological status monitoring (PSM) base layer prototype using SBIR developed technologies including electrically enabled yarns (e-yarns), electrically enabled textile (e-textile) electrodes, data and power textile circuits.



Prototype SIU-PSM Base Layer Copyright, 2018, Propel LLC.

WHAT

Operational Need and Improvement: The US Navy identified a need to develop an ensemble to advance human functionality, optimize personnel performance to account for reduced manning and to enhance the survivability of future warships by embedding technologies into the sailor's uniform to create a robust human/ship command and control interface. Naval uniforms do not exist to keep pace with evolving multi-functional human-system interface technologies envisioned for future ship command, control and operation therefore a need exists to advance the state of wearable technologies capable of seamlessly integrating with evolving ship systems.

Specifications Required: Regardless of the sailor's position, technologies will serve to wirelessly sense, process and receive/transmit information between the ship platform and the sailor. The resulting ensemble will also wirelessly communicate the sailor's position and track movement, as well as to monitor and relay the human state of health important for situations such as damage control events. Given the emergence of virtual displays, the embedded technologies shall be capable of communicating with them and leveraging their benefits. Incorporate proposed technology into preliminary demonstration models exhibiting multifunctional capabilities that are transparent to the wearer, are appropriate for clothing applications and capable of validating functionality suitable for shipboard use in a laboratory environment.

Technology Developed: Propel is developing and prototyping novel technologies to embed electrical system functionality into sailors' uniforms, permitting future integration of the sailor into the Navy's system of systems and enhancing the availability of mission-critical information for both the sailor and the Command. The Phase II demonstration prototype is a 3D knitted compression base layer garment for physiological monitoring (PSM), including measurement of wave form ECG, in an underwater operational environment.

Warfighter Value: Continuous real-time monitoring of operator physiological status to measure and predict physical and cognitive performance. Augmented operational effectiveness via uniforms with textile embedded data and power networks for enhanced Command, Control, Communications, Computing and Intelligence (C4I) capabilities. Electrically enabled textiles permitting reduced size and weight requirements for data and power networks.

WHEN

Contract Number: N00189-17-C-Z023 **Ending on:** January 11, 2019

| Milestone | Risk Level | Measure of Success | Ending TRL | Date |
|---|------------|--|------------|----------------|
| Development of washable textile electrodes | N/A | Textile electrodes sense and measure electrical signal | 4 | May 2018 |
| Development of knitted textile circuits | N/A | Functional data and power electrical circuit integrated into a wearable knit textile structure | 4 | September 2018 |
| Demonstration Prototype #1 (2 samples) delivered to NCTRF | Med | Form, fit and function meet the technical objectives | 5 | December 2018 |
| Testing by the Navy in a relevant simulated environment | Med | Reliable, high quality sensor data captured | 5 | January 2019 |
| Demonstration Prototype #2 (6 samples) delivered to NCTRF | High | Form, fit and function meet technical objectives under water | 6 | TBD |

HOW

Projected Business Model: Propel will sell physiological monitoring base layer garments, teaming with a highly qualified military contractor for initial low-rate as well as follow on full-rate manufacture. Propel will seek further RDT&E contracts leveraging the SBIR developed e-yarn and e-textile technologies and in-house prototyping 3D knitting coding and design capabilities. Propel will also license e-textile products, circuits, and electrodes as well as the associated manufacturing know-how. Propel will sell and/or enter into licensing agreements for the sale of the component e-textile technologies, such as the e-yarns.

Company Objectives: Propel's objective is to connect with Navy and other DOD programs for whom the developed e-textile technologies will be a game changer. These include opportunities for the SIU PSM garments for use in other demanding operational environments, such as when wearing the Joint Service Lightweight Integrated Suit Technology (JSLIST) for chemical and biological agent production, as well as the Explosive Ordnance Disposal (EOD) suits for bomb disposal. There are many other applications beyond PSM garments that would be enhanced by replacing traditional circuits with textile-based data and power circuits. Propel will develop the e-textile technology to be the industry leader in the design and manufacture of textile-based sensor arrays and data and power circuits.

Potential Commercial Applications: Propel's commercial opportunities for the SIU PSM base layer garment include first responder and medical patient monitoring. Athletic wear and equipment companies are also commercial targets for the highly innovative textile-based sensors developed specifically for compression e-garments. Propel will pursue market opportunities to sell subsystem components for integration for smart garments and e-textiles across a broad array of markets, including outdoor recreation products, interior textiles, automotive textiles, medical textiles, and space textiles. Opportunities in industrial products include e-textiles for integration into composite structures.

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