Department of the Navy SBIR/STTR Transition Program

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

NAVAIR

Topic # N171-008

Lightweight, highly breathable HybridSil® drysuit fabrics with instant watertight sealing

NanoSonic, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-202 Aircrew Systems

Transition Target: Naval Aviator drysuits

TPOC:
(301)342-9224

Other transition opportunities: Any pilot required to wear dry suits, also called anti-exposure or immersion suits, during routine flights over cold water as a contingency for emergency ditching or ejection would benefit; enjoying a previously unavailable combination of air permeability, immediate water tight sealing, and environmental durability.

https://www.navy.mil/management/photodb/webphoto/web_021217-N-4374S-014.jpg

Notes: The fabric technology will be compatible with existing dry suit cut/sew, welding, and adhesive processes and suitable for use and maintenance in the operational military environment. The wet and dry states will remain thin and flexible, enabling aircrew to wear constricting gear such as body armor, body harnesses, and anti-g suits while performing mission and survival tasks.

WHAT

Operational Need and Improvement: Current dry suit fabric technologies block water intrusion but also block air exchange, resulting in a hot and sweaty aviator whose ability to fly a mission is degraded. Further, a sweaty aviator is at much greater risk of hypothermia in a cold-water ditching because the sweat vapor condenses into water which conductively robs the body of its heat and convectively by degrading insulation of thermal underwear. Ultimately, the desired end capability is a commercially producible fabric technology that allows sufficient air exchange for evaporative cooling of the wearers skin but that passively and immediately reaches and holds a watertight state for 6 hours upon wetting.

Specifications Required: Detailed performance requirements are provided with target metrics. a. Fabric weight, per ASTM D 3776: <9.0 oz/yd2 b. Tear strength (Elmendorf) warp/fill per ASTM D 1424: 4.85/4.85 lbf c. Air permeability, minimum per ASTM D 737: 400 cfm d. Water vapor permeability per ISO 11092: <¬6 Ret m2xPa/W e. Hydrostatic resistance per ASTM D 3393: No leakage f. Breaking strength warp/fill per IAW ASTM D 5034: < 135/125 lbsf g. Dimensional stability per AATCC 150: <3% h. Oil repellency per AATCC 118-2002: >5 i. Pilling resistance per ASTM D 3886: >4 Any textile components used to develop the resulting material must be entirely manufactured in the United States of constituents wholly grown and/or produced in the United States.

Technology Developed: Innovative ventilating fabric dry suit technology will provide a previously unavailable combination of breathability and selective water removal enabling evaporative cooling for Naval Aviator comfort and rapid watertight sealing for protection during cold water ditching. Unlike legacy protective fabric technologies that consist of thermoplastics deposited over high strength synthetic fabrics, NanoSonic's HybridSil fabrics are produced through the infusion and crosslinking of high flex, low modulus thermosetting elastomers that covalently react/couple to functionalized scaffold fabrics to afford highly compliant ensembles with increased flexibility, environmental durability, and reduced weight.

Warfighter Value: A fabric technology that allows high air exchange yet passively self-seals to a watertight state when wetted, either as a ventilating panel in a dry suit or as the dry suit fabric itself, would increase endurance of the military aviator operating over cold water in routine ambient conditions, and survivability in a cold water ditching

WHEN

Contract Number: N68335-18-C-0646 **Ending on:** September 3, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Protoype Waterproof Bag Construction	Low	Hydrostatic Water Resistance and Breathability Targets	4	October 2019
Prototype Immersion Suit Construction and Testing	Med	Hydrostatic Water Resistance and Breathability Targets	6	June 2020

HOW

Projected Business Model: NanoSonic intends to be a distributor of its highly breathable, waterproof trilayered HybridSil drysuit fabrics. Preliminary manufacturing models indicate that pilot scale production quantities of ~1,000 linear yards/year may be realized during the Phase II program. With additional capital investment in fabric cutting equipment, NanoSonic envisions a manufacturing capability of >10,000 linear yards/year within 10-months after program completion. Consequently, NanoSonic anticipates serving as a large-scale producer and supplier of ventilating drysuit fabrics to the military and commercial drysuit manufacturing industries.

Company Objectives: NanoSonic's Phase II objective is to create a pioneering drysuit fabric using its HybridSil WEB membranes that is < 9 oz./ square yard and provides Naval Aviators with a previously unavailable combination of 1) breathability and selective water removal enabling evaporative cooling for enhanced Naval Aviator comfort and 2) rapid watertight sealing for protection during cold water aircraft evacuations. NanoSonic seeks to work with groups to develop and assist with the required qualification testing in addition to developing training for military operators and maintainers on use and support.

Potential Commercial Applications: The market for immersion dry suit fabric technology that allows air exchange when dry but is immediately watertight when wet includes not just DoD and US Coast Guard aviators but also oceanographic scientists, seafood industry watermen, and cold-season recreational canoeists and kayakers.

Contact: Vince Baranauskas, Chief Technical Officer
vince@nanosonic.com (540) 626-6266