Department of the Navy SBIR/STTR Transition Program

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Topic # N181-019
Innovative Material (and Application Method) for a Hydrophobic/Oleophobic Coating to an Aluminum-Bodied Heat Exchanger TxHiEnergy
Texas High Energy Materials, LLC

WHO

SYSCOM: NAVAIR
Sponsoring Program: PMA 275 V-22 Osprey
Transition Target: V-22 Osprey Nacelle Oil Cooler Assembly
TPOC:
(301)342-0865
Other transition opportunities: This technology could be used for other platforms for the same type of application, but the material could also be useful for other fouling concerns. V-22 appears to be unique for the severity of heat exchanger fouling.
Notes: We will execute Flight Qualification Tests at end of Phase II, after which we will seek parties interested in our patented, environmentally benign, self-cleaning binary coating technology system.

https://cdn.dvidshub.net/media/thumbs/photos/1902/5080095/1000w_q95.j
https://www.ametek.com/pressreleases/news/2014/november/hughes-treitler-awarded9-million-contract-for-v-22-osprey-nacelle-oil-cooler-

WHAT

Operational Need and Improvement: The Navy occasionally faces issues with heat exchanger performance in mechanical systems due to the accumulation of dirt and debris on the thermal transfer surfaces. Developing a cost-effective, innovative technology for a coating material and application method, designed to reduce the build-up of organic material on the thermal transfer surfaces of the heat exchanger, would increase the available usage time of a mechanical system. This would result in a decrease in cost to the Government by removing the need to clean or remove components that have diminished heat-rejection capability.

Specifications Required: Heat Exchanger Requirements with Hydrophobic/Oleophobic Coating:
- Shed water, oils, hydraulic fluids, and other foulants
- Minimal loss of air flow, pressure drop, and heat rejection
- Durable enough to withstand sand and dust ingestion
- 10 hour extreme exposure (sandblast) endurance test
- Erosion resistant and durable for 840 hours
- Operating temperature range: -65°F to 420 °F
- Maximum operating pressure: 230 psig

Technology Developed: Through our novel Chemical Vapor Deposition process, Texas High Energy Materials deposits an ultra-thin, durable, self-cleaning, omniphobic coating onto complex parts utilized by combat aircraft. Our new coating technology has been evaluated for aluminum heat exchangers, found to completely eliminate debris build up in harsh environments without reducing heat exchanger cooling performance, and reduces costs by eliminating frequent depot-level maintenance.

Warfighter Value: A material (and application method) for a hydrophobic/oleophobic coating to an aluminum-bodied, air-cooled, fluid-managing heat exchanger, with the subject heat exchanger of the tube-and-fin configuration would result in a decrease in cost to the Government by removing the need to clean or remove components that have diminished heat-rejection capability.

WHEN

Contract Number: N68335-20-C-0851 **Ending on:** August 21, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Development of a durable self-cleaning coating	Med	Coating retains self-cleaning performance after Navy prescribed endurance test	4	February 2022
Application on representative heat exchanger	Low	Complete uniform coating coverage	4	April 2022
Evaluation of self-cleaning coating on representative heat exchanger complete	Low	Coating performs as intended without reducing heat exchanger cooling performance	5	June 2022
Self-cleaning coating application onto actual V22 heat exchanger	Med	Complete uniform coating coverage	6	September 2022
Flight qualification demonstration	High	Successful completion of flight qualification demonstration	6	December 2022

HOW

Projected Business Model: Texas High Energy Materials, LLC (THEM) develops innovative materials in a practical, collaborative approach for government and private industry applications. We transition our technological breakthroughs into commercial, state-of-the-art products for government and industrial applications. THEM will engineer and design coating equipment outfitted with the controls and loading fixtures as well as software programmed to make the system easy to use by Depot personnel in addition to developing and providing a comprehensive training program, users manual, and SOPs. THEM will work with commercial heat exchanger manufacturers to determine viability of licensing the process to an existing new-build manufacturer for future V22 heat exchanger installations (Ametek, BAE, Lockheed, etc.)

Company Objectives: Our new coating technology has been evaluated for aluminum heat exchangers, and found to completely eliminate debris build up in harsh environments. This translates directly to improved fleet readiness and mobility by maintaining optimum heat-transfer performance while reducing service and cleaning intervals. We seek parties interested in maximizing thermal transfer efficiency and operational lifetime through use of our patented, self-cleaning coating technology.

Potential Commercial Applications: Commerical applications for this technology include: oil refineries (crude pre-heater trains), waste-heat recovery systems used in power generation, naphtha hydrotreaters at petroleum refineries, and air pre-heaters at municipal solid waste incinerators. Other parties interested in licensing this product would include Off-Highway vehicles, mining equipment, and automotive applications intended for off-road use. Devices that use heat exchangers in austere and also wet or day environments would benefit.

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