

Topic: N141-068

Creare LLC

Advanced Two-Phase Heat Exchangers for Environmental Control

Cryogenic refrigerators are needed to cool superconducting magnets for future naval operations. We are developing a critical refrigeration component: a compact, high-efficiency, cryogenic heat exchanger (HX). The HX builds on Creare's expertise in thermal / fluid engineering and fabrication and manufacturing process development, particularly our innovative, additive manufacturing technology used to build recuperators for small gas turbines. Our cryogenic HX will enable a compact, efficient cryocooler that will, in turn, enable use of superconducting magnets for a range of advanced naval applications, including superconducting power generation, power distribution, and magnetic energy storage. We seek customers that require superconducting systems for these advanced applications. We seek partners who build superconducting components and prime contractors who build vehicles and platforms that incorporate superconducting systems.

Technology Category Alignment:

Ground and Sea Platforms

Materials & Manufacturing Processes

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SYSCOM: NAVSEA

Contract: N68335-20-C-0320

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-20-C-0320

 Tech Talk: <https://www.youtube.com/watch?v=iFYzJFJnvEE>

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0475

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Compact Microchannel Recuperators for Cryogenic Coolers

Creare LLC

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO-501
(Unmanned and Small Combatants)

Transition Target: Small unmanned naval vessels

TPOC:
(215)897-8057

Other transition opportunities:
Degaussing and superconducting power generation. Compact heat exchangers for aircraft thermal control.

Notes: The compact heat exchangers developed in this program are enabling components for high-efficiency cryogenic refrigerators. These refrigerators generate the extremely low temperatures needed for superconducting systems



<https://www.navy.mil/Resources/Photo-Gallery?igphoto=2002333481>
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WHAT

Operational Need and Improvement: Small unmanned combat vessels can achieve higher effectiveness if they could employ superconducting magnets. The superconducting magnets must be cooled to cryogenic temperatures using a low-temperature refrigerator. The need is for a cryogenic refrigerator that is highly efficient and very compact. The largest components in these types of refrigerators are special purpose heat exchangers that enable generation of cooling at low temperatures.

Specifications Required: An order-of-magnitude reduction in size relative to conventional technology is needed before it will be feasible to use cryogenic refrigerators on small unmanned surface vehicles. Similar reductions in manufacturing cost are also essential.

Technology Developed: Creare has developed an innovative approach for manufacturing high-performance, microchannel heat exchangers. The approach has already been successfully demonstrated by producing recuperators for small gas turbine engines that are compact, high-performance, and low-cost. We are now using the same basic fabrication technology to develop compact heat exchangers for cryogenic refrigerators.

Warfighter Value: Success in Phase II will contribute to more effective operations for small unmanned combatants.

WHEN

Contract Number: N68335-20-C-0320 **Ending on:** March 1, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Gen 1 Recuperator Test	Low	High thermal effectiveness, low pressure drop, agreement with design models	5	March 2021
Gen 2 Recuperator Demonstration	Med	Meet targets targets for size, thermal effectiveness, and pressure drop	6	March 2022
Integrated Test of Cryogenic Refrigerator (Option Phase)	Med	Low power input, high cooling at low temperature	6	March 2023

HOW

Projected Business Model: Creare and affiliated companies will manufacture initial prototypes, support qualification testing and sea trials, and produce cryogenic refrigerators at low to medium volume to support Navy applications of superconductivity.

Company Objectives: The components and cooling systems we are developing under this program will be broadly useful for any Navy platform that can benefit by incorporating superconducting components. We hope to meet Navy and prime contractor personnel who are working to incorporate superconducting technology into future Navy platforms.

Potential Commercial Applications: Creare's microchannel heat exchangers can be used to improve performance of a wide range of power, thermal, and process systems. These include small and large gas turbine engines, vehicle thermal management systems, and gas separation systems.

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