Department of the Navy SBIR/STTR Transition Program

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ONR Approval #DCN# 43-10508-22

Topic # N204-A03
Deployable Systems Manufacturability
Composite Energy Technologies Inc

WHO

SYSCOM: ONR

Sponsoring Program: The Navy and Marine Corps seek to develop and demonstrate advanced deployable system manufacturing capabilities, including sensors and effectors, and the related technology innovation necessary to maintain the competitive industrial advantage.

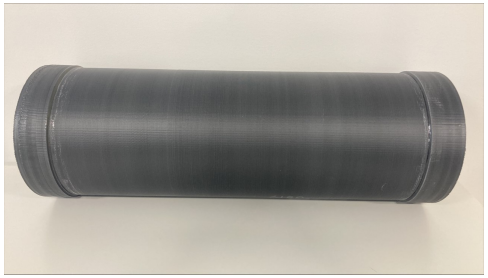

Image courtesy of Composite Energy Technologies

Transition Target: Unmanned Vehicle (UxV) manufacturability: define and develop modular UxV system fabrication and assembly technologies and conduct related materials research for UAVs, USVs or UUVs. This includes use of low cost additive manufacturing technologies and abilities to fabricate close to the point-of-need. This includes manufacturing technologies that support full ocean depth capable UUVs, expendable and reusable UxVs, as well as short and medium endurance UAVs and payloads. These systems must be rapidly reconfigurable to enable conversion of payloads to meet time critical mission needs.

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Other Transition Opportunities: Unmanned/Autonomous underwater and surface vessels made from advanced materials. Rapid prototype and deployment of sensors/effectors housed in carbon fiber pressure vessels. 3D printed foundations and bracketry allows for rapid reconfiguration of payload in an existing UXV. Composite midbody sections for UUVs that have no detectable magnetic properties.

Notes: The 19.5" long X 7.25" OD pressure vessel was 3D printed and has been tested to 900M. The two bonded endcaps provide anti-tamper protection and are designed as an expendable option. Removable end caps are also available for payload recovery and changeout for a rapidly reconfigurable option.

WHAT

Operational Need and Improvement: Sustainment of industrial capacity for technology innovation necessary for next generation deployable Naval systems is at increasing risk due to global pandemic impacts. The Navy and Marine Corps intend to aggressively continue their modernization strategy for the evolving security environment by increasing the rate of technology innovation and adoption. As the Navy moves forward with this modernization strategy, deployable and autonomous systems that extend the reach of our capabilities and offer man-on-the-loop alternatives are required for the maritime domain. It is essential to develop options for full spectrum competition and deployable systems are an element of this strategy. Strategic advantage comes from institutional capacity to develop and field new capabilities faster than our adversaries. The Navy and Marine Corps seek to develop and demonstrate advanced deployable system manufacturing capabilities, including sensors and effectors, and the related technology innovation necessary to maintain the competitive industrial advantage.

Specifications Required: The primary specifications that will drive the development of solutions will be the interior and exterior dimensions of the vehicle/vessel/structure, the operational depth for the package, the duration of the mission, the end-state of the mission e.g. leave-behind or recover and any special requirements such as anti-tamper or timed/triggered implosion.

Technology Developed: Designed pressure vessels rated to 600 meters with a factor of safety of 1.5 that are printed using a commercial 3D printer that is portable and readily serviced worldwide. Through a multitude of testing and analysis, we have determined what material works in the marine environment, and how best to control the printer to achieve repeatable results. We have also determined what material does not meet the specifications the manufacturers promise in their marketing information, greatly reducing the risk of fielding units that do not perform as designed.

Warfighter Value: To dramatically reduce the timeline from concept to deployment of advance structures that house or deliver critical capability to the warfighter in the undersea and littoral domains. Manufacturing at the point of need will allow for rapid delivery of sensors and effectors that can be placed in the maritime environment through multiple means. Reach back for reconfiguration of existing designs allows for new items to be printed with delivery of computer files, rather than physical objects. This approach will support a rapid, iterative process that will result in critical equipment being fielded in hours/days as opposed to months/years.

WHEN

Contract Number: N68335-21-C-0346 **Ending on:** Apr 27, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete Phase I of SBIR	Low	All Phase I deliverables met	3	1st QTR FY21
Phase II SBIR Start	Low	Acceptance of Phase 1 Deliverables	3	3rd QTR FY21
Environmental Testing of Materials	Medium	Material suited for ocean environment	4	1st QTR FY22
Tested 3D printed PV to 600m working depth	Medium	PV tested beyond 900m	5	2nd QTR FY22
Secured agreement to develop advanced AM techniques using advanced composites with ORNL	Medium	CRADA in process with Oak Ridge National Lab executed	5	4th QTR FY22
Cyclic testing of PV with removable endcaps to 600m working depth	High	Pass cyclic testing of a 3D printed PV with removable endcaps at 600m	6	1st QTR FY23

HOW

Projected Business Model: CET will produce a library of printable structures that are designed with exterior dimensions consistent with common methods of deploying pressure vessels, small UxVs and other devices. With exterior dimensions fixed by deployment method, the interior diameter required by the payload and material chosen will determine the depth rating of each device. The library will include various endcap designs including bonded endcaps with or without penetrations and removable endcaps with various standard fittings that can be configured based on mission need. Each design will be printed by CET to confirm the print files and material selected will result in the required characteristics. Once validated, the print files, along with a step-by-step procedure will be made available to the various commands needing this capability. Reach back to CET will be provided so any questions that arise from the field are addressed as soon as practical.
CET will also provide custom engineering and design services that will allow for rapid development and deployment of vessels/structures meeting unique or mission-specific design requirements. The process of defining new requirements, validating the new design and providing print files for use by forward deployed units will take a matter of days or weeks in comparison to the typical design/delivery cycle.

Company Objectives: To improve the speed at which structures and vessels made with advanced composites can be designed, produced and deployed at or near the point of need for the military, or the growing commercial market.

Potential Commercial Applications: Housings for cable or pipeline monitoring systems. Cost effective/light weight hulls for autonomous surface and underwater survey vehicles.

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