

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0374

Topic # A16-122

Metallic Coatings for Structural Enhancement of Polymers and Composites for Reduced Weight Missile Structure
Materials Sciences LLC

WHO

SYSCOM: NAVSEA

Sponsoring Program: TBD

Transition Target: Surface Ship and Underwater Vehicle Components and Machinery (e.g., Sealed, Underwater Vehicle Components, Industrial Tooling for Shipboard Maintenance, Diver equipment, Robotic System End Effectors, Antennas and Reflectors, Waveguides, and Heat Exchanger Tubes)

TPOC:

Other transition opportunities:

Lightweight, high strength components for aviation and missile systems, military ground vehicles, commercial aircraft, and spacecraft components



Photos courtesy of U.S. Navy, <https://www.navsea.navy.mil/> and RepliForm, <http://www.repliforminc.com>

WHAT

Operational Need and Improvement: The Navy has a need to improve the strength, durability, and thermal resistance of polymer and composite replacements of mission and safety critical parts on surface ships and underwater vehicles. These replacements have the potential to reduce cost and lead time as compared to their replacements, but sufficient performance requirements must be met. Metallic coating of polymer and composite parts produced using additive manufacturing (3-D printing) processes offers improved efficiency and performance, but the process has not been sufficiently characterized for successful implementation into the fleet. A design tool set needs to be developed that guides users to fabricate an additive manufactured, metal plated part, starting with material and geometry and invoking guidelines to optimize the plating process. The tool set will consist of: guidebooks with best practices and design constraints for implementation of plated polymer AM parts and algorithms that link material models with electroplating and structural simulation.

Specifications Required: The tool set should enable the design and production of metallic coated polymer composite components that are lower cost and provide improved multi-functional performance (structural, damage tolerance, thermal, and electrical) equal to or better than current materials and processes.

Technology Developed: Materials Sciences LLC is developing a knowledge-based tool set for improved design and manufacturing of lightweight metallic coated polymer components for low-cost, high performance structures. The approach combines three major technologies: (1) advanced material systems for balanced properties and cost, (2) state-of-the art material fabrication techniques to create highly detailed, low-cost components, and (3) specialized plating techniques to promote durability and multifunctionality (grounding, EMI, thermal).

Warfighter Value: The benefits of the design and processing tool set include: reduced fabrication cost, tailored structural performance, increased mobility and extended performance, as well as increased repeatability and reliability of parts. The tool set will facilitate the advancement and rapid implementation of additive manufacturing technology for production of lower cost parts on Navy ship structures and underwater vehicles.

WHEN

Contract Number: N68335-20-C-0283

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Process Guideline Development	Low	Validation via coupons tests	5	January 2021
Sub-Component Demonstration	Low	Successful testing of subcomponent demonstrating performance increase	5	March 2021
Full scale Demonstration	Low	Successful testing of full-scale component and meets performance metrics	6	December 2021
Design Guidebook delivered	Med	Meets Navy Acceptance Criteria	7	January 2022
Algorithm/Material Model Development	Med	Demonstration of LINKED set of analysis tools	5	February 2021

HOW

Projected Business Model: MSC's projected business model for the toolset entails a licensing strategy where engineering services will be provided to government and industry clients for component design and manufacturing, and involve training on the use of the tool set for developing in-house design and plating capabilities. In addition to working directly with the TPOC and Navy Program Office representatives to transition the technology to specific surface ship and underwater vehicle platforms, MSC will also pursue applications of the tool set for other DoD agencies such as NAVAIR and the US Air Force for aviation applications, as well as the Army and Marines for ground vehicle applications. MSC plans to engage DoD Project Offices, prime contractors and OEMs through existing business relationships to identify specific platforms and components for implementation of the toolset in their product design and production programs.

Company Objectives: Demonstrate the tool set for selected Navy ship and underwater vehicle platforms and components by 2022. Identify and pursue application to other platforms, including aircraft, ground vehicles and unmanned vehicles/vessels.

Potential Commercial Applications: The tool set can be applied to the design and production of metallic plated polymer components for automotive parts, aircraft components and industrial machinery and equipment applications to achieve sustainable production of low cost, lightweight components with improved performance .

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