

Department of the Navy SBIR/STTR Transition Program

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Topic # N162-091

Design Tool for Topological Optimization of Air-Platform Structural Components made by Additive Manufacturing

MRL Materials Resources LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO U&W

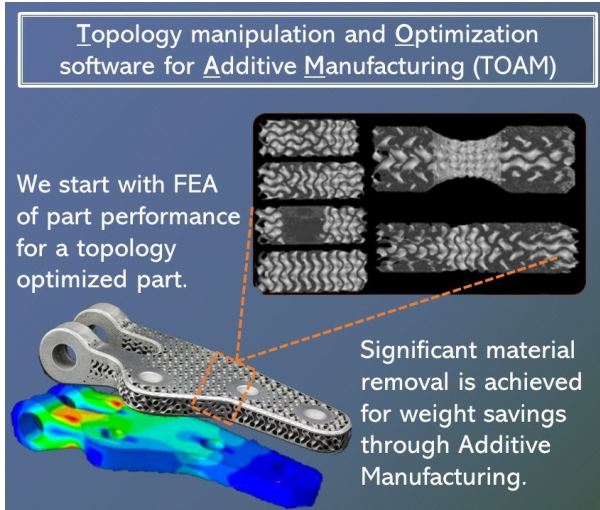
Transition Target: Tomahawk Weapons System

TPOC:

(760)939-5657

Other transition opportunities: MRL's primary transition target is to lead the industry for software used to generate CAD designs for Additive Manufacturing. This technology would enhance the performance of systems requiring lower weight with greater strength such as persistent maritime UAVs or time sensitive strike munitions.

Notes: The ONR Quality Made Current Tech team is exploring the material behavior of topology optimized designs within their modeling tools. Designs can be optimized for material performance and characterization such as light-weighting, where material is removed from the structure, making it lighter without compromising structural integrity.



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WHAT

Operational Need and Improvement: The Navy needs an integrated structural and material design tool that can exploit the benefits of Additive Manufacturing to produce novel designs for future Warcraft (aircraft, ground/amphibious vehicles, and marine) and weapons systems that cannot be fabricated by current methods. Additive Manufacturing has the potential to enhance operational readiness, reduce total ownership cost, and enable parts-on-demand manufacturing.

Specifications Required: The Navy is seeking a design tool to be integrated into existing analysis and design tools with utility for design, fabrication and testing for an air platform prototype component such as a wing or fin.

Technology Developed: MRL has developed both a standalone and server-client computing solution for topology optimization and manipulation for additively manufactured parts. This approach rapidly produces manufacturable, lightweight, strong parts with minimal requirements on user expertise and familiarity with topology optimization.

Warfighter Value: The primary value to the warfighter is greater performance. The warfighter experiences the repercussions of sub-optimally designed parts with heavy, slow, and difficult to maneuver/transport vehicles, equipment, and structures. Our software will allow for a tactical advantage over our adversaries with new designs that leverage the capabilities of additive manufacturing. The ability to achieve the maximum strength and performance possible from currently existing materials with the least amount of material will enhance our strategic abilities. This approach can be used to generate designs for new components but can also be used to replace legacy components to extend the life of aging fleet. Replacement parts could be redesigned and produced on an as-needed basis, thus improving our military readiness and extending the useful life of Warcraft awaiting replacement parts.

WHEN

Contract Number: N68936-18-C-0012 **Ending on:** January 20, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Revamped User Interface for Cloud Use	Low	Full application running on in-house servers for widespread internal use	7	October 2021
In-User Interface for a Finite Element Analysis application	Med	Capability to set up static load cases in MRL's TOAM application precluding the need for additional software	5	November 2021
Tailorable Multi-Objective Optimization within the User Interface	Med	Ability to perform a DoE of parameters within TOAM framework	4-5	December 2021
Rapid generation of new geometries using hardware acceleration for near real-time geometry regeneration and visualization	Low	Time required to generate new geometries should stay under 5 seconds	7	August 2021

HOW

Projected Business Model: Our business model is twofold:

1. Selling software licenses to engineering firms/DoD/etc. that produce CAD models for 3D printing
2. Providing consultant work to produce unique CAD models using our software for companies that can't yet justify the purchase or produce too few models a year which necessitate owning a software dedicated to producing highly complex optimal models.

Company Objectives: Our goal as a company is to solve problems in the additive industry and produce solutions that allow any designer to build high quality parts with model-based qualification to support the use of the parts. MRL's secondary goal is to expand on our consulting capabilities and services to help industry leaders rapidly produce well designed parts made by additive manufacturing.

Potential Commercial Applications: The automotive and medical industries can both benefit greatly from the software MRL is providing. High performance road-going vehicles such as Koenigsegg's CCX and Agera both use 3D printed turbochargers that, with modified topologies, reduce unsprung mass for greater performance. The medical industry uses a number of unique topologies for greater osseointegration. MRL has filed a patent for a particular implementation of our software to generate a new medical implant with improved osseointegration. Any company that specializes in manufacturing high quality implants that maximize osseointegrative qualities would benefit from our software.

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