Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-865

Topic # N18B-T031

Scalable Manufacturing of Composite Components using Nanostructured Heaters

Metis Design Corporation

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-262

Transition Target: MQ-4C Triton UAS

TPOC:
(301)757-2338

Other transition opportunities: CH-53K

Notes: To date we have fabricated flat void-free composite panels using this approach up to 60 x 60 cm, and 64-plies thick, as well as some curved parts. Most testing has been conducted on IM7/8552 prepreg, including Dynamic Mechanical Analysis (DMA), Degree of Cure (DOC), Short Beam Shear (SBS, both static & dynamic), however we have also used this approach to cure other carbon and glass unidirectional and woven prepregs, as well as other thermoset and thermoplastic matrices.

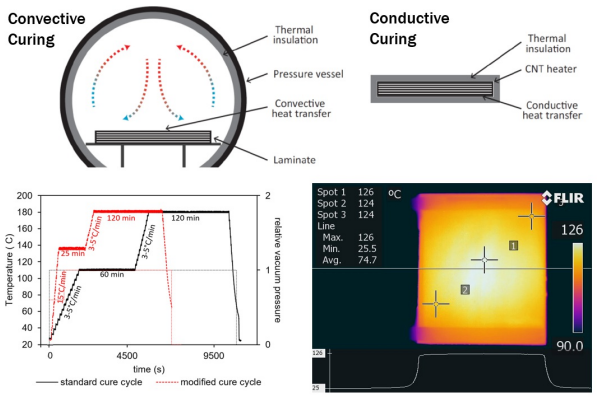

Image courtesy of Metis Design Corporation

WHAT

Operational Need and Improvement: Composite materials are being employed in more primary structure applications for each new generation of DoD vehicle. The benefit of composite material is that it has a higher specific strength and stiffness, therefore for the same mechanical performance one can make a much lighter structure. Composites are also corrosion and fatigue resistant, and can be molded in larger sections therefore reducing fastener counts. The main downside to composites however, is the cost of manufacturing, including both the upfront tooling investments as well as the ongoing cost of curing the material in an autoclave.

Specifications Required: Any new process would need to meet or exceed present day properties for static, dynamic and environmental performance. Ideally, the final composite parts would be an identical drop-in replacement with no changes to the design or operation necessary. The total cost of implementing the new process must be substantially lower than the traditional cure process to justify the change.

Technology Developed: The Out of Oven (OoO) approach utilizes thermal insulating tooling with embedded carbon nanotube (CNT) surface heaters to conductively cure traditional autoclave prepreg without the need for pressure. The cure is performed under vacuum following a modified cure cycle that has been demonstrated to produce typical composite material properties. The CNT provides fast, uniform and efficient heating, which is key to being able to eliminate the requirement for an autoclave cure.

Warfighter Value: The OoO process reduces the cost of fabrication of composite components by as much as 50% by reducing the electrical costs by multiple orders of magnitude. Further, tooling costs would be greatly reduced, which enables composite parts to be prototyped and iterated more practically without the traditionally lead times and expenses associated with high-pressure autoclave tools.

WHEN

Contract Number: N68335-20-C-0213 **Ending on:** May 20, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Scaled manufacturing	Low	Fabrication of 60x60cm part	4	August 2020
Non-flat manufacturing	Low	Fabrication of curved part	4	September 2020
Statistical Testing	Low	Test report on standard composite property comparison	5	September 2020
Durability Testing	Low	Test report on advanced composite properties	5	December 2020
Component Demo	Low	Fabrication of a representative UAV component	6	May 2021

HOW

Projected Business Model: There are multiple potential business models that are open for discussion with potential partners. These include a spin-out company devoted to design and fabrication of CNT-heated tools, a Joint Venture that accomplishes the same, or potentially a licensing deal for the IP behind the CNT heating for an existing company that would like to market these capabilities

Company Objectives: We are seeking program office support for customization and evaluation of this technology with respect to their application needs. We are also seeking investors or licensing partners interested in developing a business model around this IP.

Potential Commercial Applications: This technology could be applied to anything that uses composite materials ranging from aerospace to automotive and sporting goods. Further, the reduction in fabrication costs and sunk investment costs in tooling and autoclaves could make composite applicable to other markets that cannot consider them to be financially practical today.

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