Department of the Navy SBIR/STTR Transition Program

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Topic # N192-084 Room Temperature Shelf-Life Pre-Impregnated Carbon Fiber Fabric for use in Out-of-Autoclave Aircraft Repair Cornerstone Research Group, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-261 H-53 Heavy Lift Helicopters

Transition Target: Primary structures and repairs on the CH-53K

TPOC: (301) 342-9369

Other Transition Opportunities: Any program that supports composite aircraft has similar needs for this technology, which includes but is not limited to JSF, FA/-18. and V-22.

Notes: CRG teamed with Battle Sight Technologies to develop and mass produce a special crayon for



https://media.defense.gov/2020/Aug/18/2002479456/-1/-1/0/200619-N-BF209-001.JPG

warfighters, first responders and disaster relief workers. Dubbed CrayTac, this device allows troops to write messages or draw complex figures on walls, sidewalks and other surfaces. The markings are invisible except to someone wearing night-vision goggles.

WHEN Milestone	Contract Number: N68335-21-C-0779		Ending on: Mar 28, 2023		H
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WHAT

Operational Need and Improvement: The resin pre-impregnated fabrics (pre-pregs) the U.S. Navy currently uses require storage at or below freezing. This requirement drives up sustainment cost and limits the ability to perform certain types of Organizational level (O-level) repairs where freezer storage is not readily available. The fabrics also must be cured in an autoclave or through a Double Vacuum Debulk (DVD) procedure, which drives the need for expensive equipment to support repairs and also limits the location of where repairs can be performed. Only a few commercially available room temperature storage pre-pregs can be cured outside of an autoclave but these materials need to be cured at relatively high temperatures (>250°F) and frequently yield high porosity laminates. The required processing exposes the parent materials to conditions outside their operational temperature windows, which can result in degradation of material properties. Additionally, higher porosity causes poor laminate quality and can result in premature part failure.

Specifications Required: The pre-preg would be expected to meet the following requirements: can be produced as a plain woven and an unidirectional carbon fiber fabric, minimum shelf life of 1 year when stored in a hangar (100°F), reasonably tacky in order to perform repairs on part surfaces oriented vertically or horizontally, reasonably drape-able to form over complex curvatures with as small as a 4 inch radius or less, able to achieve a cure percentage of at least 95% when cured on aircraft, can be cured in an uncontrolled environment, ideally but not limited to 45-65% humidity at 65-75°F, cure time of 2.5 hours or less, cure cannot expose the part to temperatures greater than 200°F, porosity of laminate less than 4% by volume, wet glass transition temperature (Tg) of at least 230°F, but a higher wet Tg is desirable, exposure to common aircraft fluids should not cause degradation of mechanical properties greater than 11% of the original strength.

Technology Developed: CRG will reduce the logistical burden and complexity associated with performing composite aircraft repairs by providing composite prepreg systems with extended shelf-stability and compatibility with out-of-autoclave cure processes commonly used by aircraft maintainers. CRGs approach enables both stable ambient storage and lower-temperature, non-autoclave cure to simplify logistics and repair operations.

Warfighter Value: Long shelf-life prepregs with minimal storage requirements; safe handling and transport to forward repair sites; and reduced logistical and organizational burden to repair composite platforms

ted Business Model: CRG is projecting commercializing this technology and bringing it to market via ng to current aerospace resin and prepreg suppliers and sustainment product providers. CRG ly is in discussion with possible commercial product outlets in the procurement chain and has worked ese organizations previously to supply products to the DoD and commercial market.

any Objectives: Beyond the foundational NAVAIR development, CRG envisions application of this loav to the breadth of the defense industry currently fielding composite platforms. This includes both D and prime OEMs. Immediate adopters to match the technology to application needs would be ers such as Sikorsky, Lockheed Martin, and Northrup Grumman.

al Commercial Applications: The private aerospace sector, along with any small composite ion shops, will also have interest in this technology not only for repair but for primary structures. emperature shelf life would eliminate the need for freezer storage thus reducing the logistical nt. It would also significantly extend the working life of the material, which would allow for the ion of larger parts without pushing the materials out time envelope. A capable, out of autoclave al would reduce the cost associated with composites fabrication by eliminating expensive autoclave on. Materials could be cured using a conventional oven which would open composite fabrication to ompanies.

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