

Topic: N161-017

Materials Sciences LLC

Efficient On-Aircraft Composite Repair Process Requiring Minimal Support Equipment

A craft-specific Structural Repair Manual (SRM) for composite components is developed to guide craft technicians through in-situ repairs for a wide-range of in-service damage scenarios. Accompanying material kit recommendations and critical flaw size guidance documentation enable high-quality out-of-autoclave repairs. Materials Sciences LLC (MSC) is an engineering and manufacturing company focused on applying material mechanics to create unique solutions for DOD and commercial customers. Although tailored specifically for the Ship-to-Shore Connector (SSC) components, the analysis and validation procedures developed can be appropriated for various composite crafts and their associated components. A zonal mapping system, in which micromechanics data is assessed alongside global stress analysis, provides further localized damage information. MSC aims to collaborate with additional DOD platforms that require robust composite damage and repair modeling systems.

Technology Category Alignment:

Materials & Manufacturing Processes

Ground and Sea Platforms

Air Platforms

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SYSKOM: NAVSEA

Contract: N68335-19-C-0250

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0250

 Tech Talk: <https://www.youtube.com/watch?v=hJozXVKRFyo>

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0419

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WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO SHIPS – PMS 377

Transition Target: Ship-to-Shore Connector (SSC), Landing Craft Air Cushion (LCAC)

TPOC:

(202)781-0448

Other transition opportunities: The development of a Structural Repair Manual and methodology is transferable to relevant Defense-related products consisting of composite reinforced materials



Photo courtesy of Textron Systems,
<https://www.textronsystems.com/products/ship-shore-connector>

WHAT

Operational Need and Improvement: The current Navy repair procedure for on-craft damage of fiber reinforced composite materials is limited in the size of the repair allowable, is expensive and creates logistical challenges when repairs are needed on landing craft detachments. A repair process is desired that provides repair patches of the same or better quality, but minimizes required support equipment and is less labor intensive.

Specifications Required: The proposed process should minimize the amount of support equipment required to reduce the logistics requirement. Total time required to prepare and cure the repair patch should be minimized, not to exceed 8 hours, and should accommodate both flat and curved laminates of thickness up to 0.120 inches while achieving porosity below 4%. The repair materials must provide properties equivalent to or better than the current process.

Technology Developed: MSC is developing a robust composite material characterization and repair methodology for Navy's next-generation Air Cushioned Vehicle (ACV), the Ship-to-Shore Connector (SSC) components. This effort will culminate in a comprehensive Structural Repair Manual, which details procedures for inspecting, assessing, and repairing a wide range of on-craft damage. This manual will be accompanied by a Flaw Criticality Handbook, which serves as a guide to the inspector or craft technician surveying the extent of damage, providing recommendations as to type of repair required based on defect parameters exhibited.

Warfighter Value: The Structural Repair Manual and Flaw Criticality Handbook, together with repair material recommendations, provide Navy craft technicians with detailed explanations on inspecting, assessing and repairing damage to advanced composite components. This documentation will allow for high-quality in-situ repairs to be conducted with a good degree of confidence in the repair integrity, and potentially reducing craft down-time.

WHEN

Contract Number: N68335-19-C-0250 **Ending on:** April 24, 2021

| Milestone | Risk Level | Measure of Success | Ending TRL | Date |
|---|------------|--|------------|----------------|
| Flaw Criticality Compendium Development | Low | Validation of FE Analysis via Inspection/Testing | 4 | September 2020 |
| Sub-Component Validation Demonstration | Low | Successful Repair/Test/Inspection of Sub-Component Scale | 5 | March 2021 |
| On-Board Validation | Med | Successful Repair and Inspection of Full-Scale Component | 7 | April 2021 |
| Delivery of Structural Repair Manual | Low | Meets Navy Acceptance Criteria | 7 | April 2021 |

HOW

Projected Business Model: MSC has extensive experience in the design and fabrication of Navy composite craft components. The in-house expertise and established capabilities can be translated to other DOD-related craft consisting of composite reinforced materials. As such, the development of a Structural Repair Manual and methodology is also transferable.

Company Objectives: Complete a Structural Repair Manual by 2021. Pursue further opportunities on subsequent Navy platforms.

Potential Commercial Applications: Service can be provided to the commercial aerospace or naval industry to develop internal repair procedures/documentation.

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