TECHNOTES

A PUBLICATION OF THE COMPOSITES MANUFACTURING TECHNOLOGY CENTER

Spring 2020 Edition

Composites Manufacturing Technology Center

Features: The Spring 2020 Edition features three recently completed projects that amount to a potential savings of **$10M**!

PROJECT DEVELOPMENT PROCESS

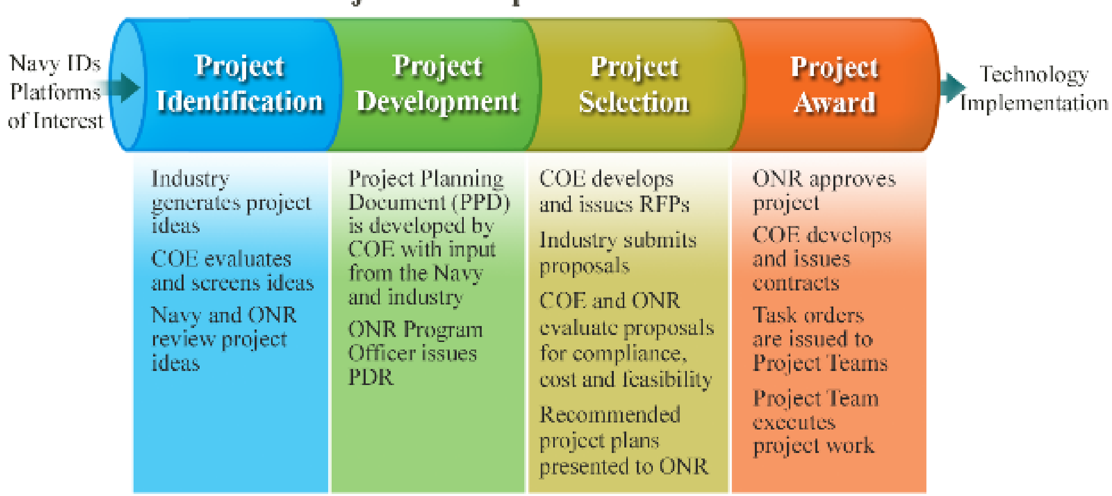
A REPRESENTATION OF CMTC'S PROJECT DEVELOPMENT PROCESS

The project development process is based on five core principles:

- Select the right topics. Clearly defined priorities for research areas are driven by a lean, responsive approach that combines ONR, Navy PEO and industry input;
- Develop smart approaches using the best talent available across the Navy-Industry-University enterprise;
- Find the best provider to conduct the research and transition it – using a streamlined process with the people and decision tools that will reliably select successful approaches;
- Employ a responsive process that will get research moving quickly while providing safeguards required for federal funding; and,
- Ensure enough projects have been developed to provide an active portfolio and a stable of fundable alternatives to maximize return-on-investment as a product of funding availability.

ATI uses a technical project selection and development process that includes a proven, stakeholder-preferred method of identifying and prioritizing technologies that are highly likely to be implemented by industry and support Navy acquisition and in-service program needs. This process can be categorized into four semi-discrete sub-processes: (1) project identification, (2) project development, (3) project selection, and (4) project award as outlined below.

Project Development Process



Led by: **Sponsored by:** **Managed by:**

ADVANCED TECHNOLOGY INTERNATIONAL®

Document Control Number (DCN #): 43-6421-20. Distribution A. Approved 12 MAY 2020

DEVELOPMENT OF FIRE SAFE RESINS FOR SUBMARINE APPLICATIONS

Q2533-2 — COMPOSITE MANUFACTURING TECHNOLOGY FOR FIRE SAFE RESINS PHASE 2

STATUS:
Project Complete

PERIOD OF PERFORMANCE:
April 2018 to November 2019

PLATFORM:
VCS/CLB Submarines

STAKEHOLDER:
PMS 450, PMS 397

MANTECH INVESTMENT:
$640,000

Objective

Applications to reduce acquisition and life-cycle costs, decrease weight, and improve manufacturing lead time on submarines have predominantly been limited to the outside of the pressure hull. That is no longer the case, but in order to use composite materials internal to submarine pressure hulls, the U.S. Navy requires that they be qualified to MIL-STD-2031 (Fire and Toxicity Test Methods and Qualification Specification). While some existing composite systems have been approved for use within the submarine pressure hull, they have been unreliable due to high void content and exhibit relatively high manufacturing cost and complexity.

Phase 1 of the Composites Manufacturing Technology Center (CMTC) Fire Safe Resins project was successful in identifying and verifying a material system which met the performance requirements. In addition, an affordable manufacturing process was developed and demonstrated for the material. Phase 2 continued to identify and improve manufacturing processes that enhance design capabilities. New mechanical properties were generated to replace those that were based on the legacy phenolic material system.

Payoff

Phase 2 of this project finalized processes, methodologies, and materials that can be used to bring composites within the pressure hull. The applications targeted will replace metal components in corrosive environments, thereby reducing the life-cycle costs of submarines. The manufacturing improvements made to phenolic core systems and phenolic laminates can be leveraged to applications industry-wide and provide far-reaching improvements to multiple Department of Defense platforms. The high quality associated with the phenolic material system is expected to provide components that are less expensive and last longer than more advanced materials, which might meet both inboard fire requirements and the needs of the selected components.

Assuming implementation on all Block V Virginia Class submarines (VCS) and following ships, as well as all COLUMBIA Class submarines (CLB), total estimated acquisition savings of $2.2M are possible for just one application currently being pursued. The estimated return on investment is 2.5 over the total life of both the VCS and CLB programs.

Implementation

This project is a follow-on to Q2533-1. Fire Safe Resins Phase 2 (Q2533-2) will fabricate an actual submarine component for insertion in a VCS hull. Such implementation will open the door for future internal composite submarine components, create opportunities to demonstrate techniques that can be used for a direct replacement of internal metallic components with composite materials, and may lead to previously untapped acquisition and life-cycle savings opportunities.

CMTC IS NOW ACCEPTING RESEARCH PROJECT CONCEPTS

CMTC IS CURRENTLY ACCEPTING PROJECT IDEAS THAT WILL REDUCE THE COST AND TIME TO MANUFACTURE OR IMPROVE THE PERFORMANCE OF THE FOLLOWING U.S. NAVY PLATFORMS.

- Columbia Class Submarine
- DDG 51 Class Destroyer
- CVN 79 Class Carrier
- F-35 Joint Strike Fighter
- Virginia Class Submarine
- FFG(X)

To discuss your project ideas, please contact:
Nick Melillo - Technical Director, CMTC
Phone: 843-760-3580
Email: Nick.Melillo@ati.org

NEW PROJECTS

M2819

Thermoplastic Composite Sunshields for Navy Ready Service Lockers

PERIOD OF PERFORMANCE: SEP 2019 TO JUN 2020	**PLATFORM:** SURFACE COMBATANTS
STAKEHOLDER: NAVAL SURFACE WARFARE CENTER	**MANTECH INVESTMENT:** $800K

Advanced Technology International, under contract with the Office of Naval Research (ONR) is investigating composite alternatives to baseline metallic sunshields on Navy Ready Service Lockers (RSL). The baseline metallic sunshields have a relatively low acquisition cost but require significant maintenance or frequent replacement due to severe corrosion. A composite solution is desired to eliminate or greatly reduce the life cycle costs associated with maintenance of the current design.

M2827

CIAM Cost Reduction Trade Study

PERIOD OF PERFORMANCE: OCT 2019 TO MAR 2020	**PLATFORM:** F-35
STAKEHOLDER: JSF PROGRAM OFFICE	**MANTECH INVESTMENT:** $300K

The Joint Strike Fighter (JSF) F-35B Variant Propulsion System utilizes the Rolls-Royce LiftSystem® to achieve short take-off and vertical landing (STOVL) capability. The Rolls-Royce LiftFan® generates the forward vertical thrust in the LiftSystem®. In order to improve certain aero-mechanical effects at the blade tips of rotor #1 of the LiftFan®, a tip treatment is used. The tip treatment was developed using technology from The Central Institute of Aviation Motors (CIAM) and has simply become known as a CIAM or CIAMs in the LiftFan®. Rolls-Royce experiences multiple issues with the current CIAM design and associated manufacturing processes, specifically related to the erosion coating and the adhesive application.

A2765

F-35 Automated Optical Measurement System

PERIOD OF PERFORMANCE: SEP 2019 TO AUG 2021	**PLATFORM:** F-35
STAKEHOLDER: JSF PROGRAM OFFICE	**MANTECH INVESTMENT:** $2.6M

The optical inspection and evaluation of the F-35 transparency is highly subjective and dependent on individual operator capabilities to detect and characterize defects. The variability induced in the process by this subjectivity negatively impacts the ability to consistently deliver a quality product to the end user as well as requires multiple, repetitive inspection steps to prevent the escape of non-conforming units. A suitably reliable and cost effective method to objectively quantify and evaluate optical defects is required to remove operator sensitivity from the inspection process and reduce total cost of inspection. Such a method if accepted by the F-35 community would eliminate multiple inspections from point of manufacture, framing, preparation for installation and on-aircraft evaluation by pilots. Considerable savings could be realized across the entire value stream through reduction in labor as well as the cost and schedule disruption caused by downstream rejections.

A2739

CH-53K Flexbeam Fabrication

PERIOD OF PERFORMANCE: NOV 2019 TO FEB 2022	**PLATFORM:** CH-53K
STAKEHOLDER: PMA-261	**MANTECH INVESTMENT:** $5.2M

Existing CH-53K tail rotor blade flexbeams are expensive to manufacture and are predominately built using a manual lay-up process. Each flexbeam is manually laid up. Current process inefficiencies include: significant labor for manual debulking, raw material waste, ply kitting / interim kit storage and transfer, and manual layup. The current flexbeam process currently requires significant labor hours and flow time to manufacture, making full rate production quantities difficult to meet without significant process improvements.

Design of Experiments to Decrease Manufacturing Recurring Costs of CH-53K Honeycomb Core Sandwich Panels

Objective

A large portion of CH-53K composite structures are designed as honeycomb core sandwich panels. The core is potted in select locations to provide reinforcement and a moisture barrier for fastener locations and internal edges. However, many of these honeycomb core sandwich panels have experienced persistent issues with inconsistent core potting quality, mainly in the form of voids, which can compromise the performance of the parts. Furthermore, these defects require Material Review Board (MRB) activities, which add cost, weight, and the potential for scrap.

The purpose of this Composites Manufacturing Technology Center (CMTC) project was to decrease the overall recurring manufacturing cost of CH-53K airframe components by delivering a uniform product, thus reducing rework, repair, and scrap without a negative effect to quality, performance, cost, and weight. This project is centered on a design of experiments technology improvement plan for core densification.

Payoff

Based on 13 core parts reviewed and their historical total MRB disposition rate of 60 percent, the projected cost of the associated MRB activity over the planned CH-53K production program of 190 aircraft amounts to just over $1.7M. By improving the core potting process and reducing MRB activity to a maximum of 12 percent versus the current 60 percent, a savings of $1.4M for these 13 parts would be achieved over the life of the CH-53K program. The return on investment is 2.3:1 over the life of the program.

Implementation

Initial implementation will occur on CH-53K; however, the technology is applicable to multiple platforms where densified honeycomb core structures are prevalent. Implementation is anticipated to occur in FY2020 at Aurora Flight Sciences.

Process improvements / optimization details resulting from this project will be documented in a final report as well as shared at CH-53K Airframe Supplier Program Management Reviews, TCC's bi-annual events, and industry forums, as applicable. The final report will be the basis for formal process specification updates (as applicable), a "Best Practices" document, as well as design and manufacturing operation sheet updates, if applicable.

M2738: CH-53K Sandwich Panel Core Potting Optimization

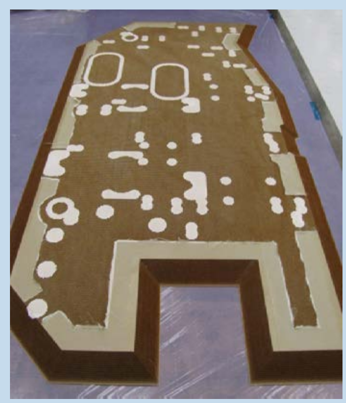
STATUS:
Project Complete

PERIOD OF PERFORMANCE:
July 2018 to October 2019

PLATFORM:
CH-53K

STAKEHOLDER:
PMA-261

MANTECH INVESTMENT:
$350,000



S2723-A1: False Deck Panel Improvement Phase 1

STATUS:
Project Complete

PERIOD OF PERFORMANCE:
July 2018 to December 2019

PLATFORM:
DDG 51, CVN

STAKEHOLDER:
PEO (Ships) DDG 51 PMS 500
PEO Aircraft Carriers, CVN Program Office, PMS 379
PMS400D

MANTECH INVESTMENT:
$547,000 (iMAST)
$968,000 (CMTC)

Objective

In order to inspect and access electrical and HVAC systems aboard the Arleigh Burke (DDG 51) class guided missile destroyer and both the Ford and Nimitz class aircraft carriers (CVNs), a false deck covering throughout their electronic spaces is required. For these platforms, the current composite decking is a structural sandwich panel with a 3/16-inch honeycomb core, faced with two plies of glass fiber reinforced plastic (GFRP), and covered on both upper and lower surfaces with a wear surface. To ensure a watertight seal, the panels require a multi-step edge treatment around the perimeter as cuts are made to fit around objects during installation. The process of cutting and sealing edges is highly labor-intensive, as some platforms have as much as 1,600 panel pieces. Additionally, the wear surface is prone to cracking, chipping, and delaminating in service. To meet cost-reduction targets and improve the supply base, an alternative panel solution was evaluated. The objective of this Manufacturing Technology (ManTech) project was to develop an improved false deck manufacturing approach and/or installation process that met the requirements of all applicable naval surface fleet platforms. This project investigated commercially available products and innovative designs to identify a viable solution.

Payoff

Successful implementation of an improved false deck system is anticipated to provide the following benefits:

- Increased productivity and throughput by eliminating time for cutting and edge treatment steps; a streamlined installation process
- A reduction in panel fabrication time by as much as 75% (DDGs)
- A reduction in cracking, chipping, and delamination of the panel during installation and removal operations
- A reduction in maintenance burden on the ship’s crew, which translates into lower lifecycle costs

Total ManTech savings for 12 DDG hulls and 3 CVN hulls is $6.4M. The five-year ROI is 2.12 and is expected to improve when applied to other classes of ships and back-fit onto the in-service fleet.

Implementation

NAVSEA will develop a Military Performance Specification document that will define material and performance characteristics requirements for all U.S. Navy surface ships. This project will work collaboratively with NAVSEA to ensure the proposed false deck panel alternatives meet acceptance requirements and constitute a viable solution to support false deck development and ship integration. Additionally, a full-scale prototype design mock-up will be demonstrated for both the DDG and CVN. The results of this ManTech project are anticipated to be implemented by 2020.