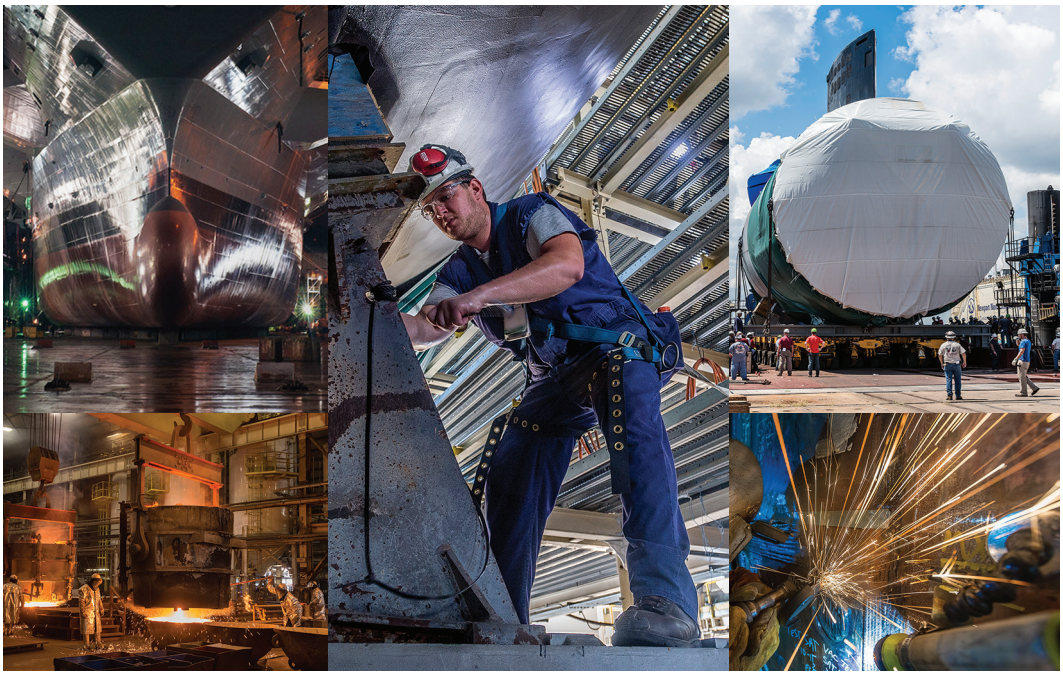
. . . transitioning affordable manufacturing technology to the Fleet

2017 Navy ManTech
Project Book



Contents

2017 Navy ManTech Project Book: This 2017 edition of the Navy ManTech Project Book provides brief write-ups for most of the Navy ManTech projects active in FY16. To highlight the Navy ManTech's Cost Savings Investment Strategy, with its concentration on development of manufacturing technology for the key platforms, the projects are organized by platform. Please contact the Points of Contact listed in the project write-ups for additional information on any Navy ManTech project.

Projects by Platform:

Index:

The Navy ManTech Program has been making a difference improving the affordability of Navy platforms critical to the future force. We have targeted our investments on manufacturing technologies to assist key acquisition Program Offices in achieving their respective affordability goals - both acquisition and life-cycle affordability. As we look to the future, we will continue our focus on key Navy platforms: VIRGINIA Class Submarine (VCS)/OHIO Replacement (OR), DDG 51 Class Destroyer, CVN 78 Class Carrier, Joint Strike Fighter (JSF), and the CH-53K Heavy Lift Helicopter.

Transition remains the guiding principal of our program. For Navy ManTech, transition occurs when the ManTech project has been successfully completed, meeting the defined goals and objectives of both the relevant industry and the Program Office, in time to support implementation. Technology Transition Plans, required for each project, specify clearly and succinctly what will be accomplished with ManTech funds, the basis on which transition will be declared complete, and the resources that will be provided by other entities in order to actually implement the technology. The resources for implementation are typically provided by entities other than ManTech, such as the acquisition Program Office or industry. Hence, although ManTech understands the importance of implementation and is exerting its resources to track implementation, it is recognized that ManTech can transition needed manufacturing technology but cannot control actual implementation.

The Navy ManTech Implementation Risk Assessment and Management Process is being used both to assess potential future projects (those in the planning stages) as well as ongoing projects. For ongoing projects, risks are discussed during periodic Program Reviews to ensure ManTech is on the same page as the acquisition and industry stakeholders. For projects in the planning phases, the goal is to recognize risks to implementation upfront and, by doing so, prioritize funding of affordability projects that have the greatest probability of implementation.

Understanding and assessing the progress made in helping platforms meet their affordability goals is essential to the program's success. To do this, Navy ManTech semi-annually updates our affordability assessment information which identifies cost savings / avoidance per project and an estimated total savings per platform. Affordability assessments on a per-platform basis, bought off by both the relevant Program Offices and industry, demonstrate the cost reduction potential and the benefits of transition and implementation.

The purpose of this publication is to provide a readily accessible source of information on the Navy ManTech Program, our investment and execution strategies, and contact information for our key players. We hope that this will be a valuable resource for members of industry, government, and academia.

I look forward to continuing to work with all of you to improve on the successes of the Navy ManTech Program. It is even more critical in the current budgetary environment to put our resources to the best use, and I am confident that the continued collaboration of ManTech, Program Offices, and industry on cost-reduction opportunities can and will help platforms achieve both acquisition and life-cycle affordability goals.

John U. Carney
Director, Navy ManTech

Navy ManTech Overview

The Navy Manufacturing Technology (ManTech) Program responds to the needs of the Navy for the production and repair of platforms, systems, and equipment. It aids in achieving reduced acquisition and total ownership costs by developing, maturing, and transitioning key manufacturing technologies and processes. Investments are focused on those that have the most benefit to the Warfighter.

For over ten years, the Navy ManTech Program has been focused on affordability improvements for key acquisition platforms. Our current focus is on: the VIRGINIA Class Submarine (VCS)/OHIO Replacement (OR), DDG 51 Class Destroyer, CVN 78 Class Carrier, the Joint Strike Fighter (JSF), and the CH-53K Heavy Lift Helicopter. ManTech helps these Navy programs achieve their respective affordability goals by transitioning needed manufacturing technology which, when implemented, results in a cost reduction or cost avoidance (measured as $/hull or $/aircraft).

Navy ManTech works with defense contractors, the Naval Research Enterprise, Navy acquisition Program Offices, and academia to develop improved processes and equipment. The Program is structured to promote timely implementation to strengthen the defense industrial base. With their expertise in specific technology areas, the Navy ManTech Centers of Excellence (COEs) play a key role in the definition and execution of the Program.

Together with the Navy ManTech Program Office, representatives of the customers, industrial entities, and the COEs function as a team to define projects that address the needs of the Navy in time to make a difference. As an example, extensive interaction and cooperation between Navy ManTech, Navy ManTech COEs, General Dynamics Electric Boat, Huntington Ingalls Industries – Newport News, PEO (Subs), and the PMS 450 Program Office has resulted in a focused ManTech initiative for the VIRGINIA Class submarine (VCS). To date, technology from 39 of the portfolio's approximately 112 projects have been implemented for a resulting real acquisition cost savings of over $35.5M per hull, verified by our industrial partners and PMS 450.

The Navy ManTech Program is managed by the Office of Affordability Initiatives within the Technology Directorate of the Office of Naval Research (ONR), with direct oversight from the Chief of Naval Research. With the transition of technologies to the Fleet and acquisition as top priorities, ONR's Technology Directorate is composed of transition-centric programs including ManTech, Future Naval Capabilities (FNCs), the Small Business Innovation Research (SBIR) / Small Business Technology Transfer (STTR), and other transition initiatives.

The directors of the ManTech programs of the Army, Navy, Air Force, Defense Logistics Agency (DLA) and Missile Defense Agency (MDA) coordinate their programs through the auspices of the congressionally-chartered Joint Defense Manufacturing Technology Panel (JDMTP) with representation from the Office of the Secretary of Defense (OSD), the Department of Commerce's National Institute of Standards and Technology (NIST), the Department of Energy, the Defense Advanced Research Projects Agency (DARPA), and industry. The JDMTP is organized to identify and integrate requirements, conduct joint program planning, and develop joint strategies. Department of Defense (DOD) oversight is provided by the Office of Manufacturing and Industrial Base Policy (MIBP) which was established by the 2011 National Defense Authorization Act (NDAA) to ensure that the linkage between industrial policy and manufacturing is firmly established and effectively coordinated.

Navy ManTech Objectives

The overall objective of the Navy ManTech Program is to improve the affordability and readiness of Department of the Navy (DON) systems by engaging in manufacturing initiatives that address the entire weapon system life cycle and that enable the timely transition of technology to industry to support the Fleet. More specifically, DOD Directive 4200.15 states that ManTech investments shall:

1. Aid in the economical and timely acquisition and sustainment of weapon systems and components.
2. Ensure that advanced manufacturing processes, techniques, and equipment are available for reducing DOD materiel acquisition, maintenance, and repair costs.
3. Advance the maturity of manufacturing processes to bridge the gap from research and development advances to full-scale production.
4. Promote capital investment and industrial innovation in new plants and equipment by reducing the cost and risk of advancing and applying new and improved manufacturing technology.
5. Ensure that manufacturing technologies used to produce DOD materiel are consistent with safety and environmental considerations and energy conservation objectives.
6. Provide for the dissemination of Program results throughout the industrial base.
7. Sustain and enhance the skills and capabilities of the manufacturing workforce, and promote high levels of worker education and training.
8. Meet other national defense needs with investments directed toward areas of greatest need and potential benefit.

Navy ManTech Investment Strategy

The Navy ManTech Investment Strategy concentrates ManTech investments on reducing both the acquisition and life-cycle costs of key Navy acquisition programs. ManTech transitions manufacturing technology which, when implemented, results in a cost reduction or cost avoidance. Platforms for investment are determined by total acquisition funding; stage in acquisition cycle; platform cost reduction goals; cost reduction potential for manufacturing; and other factors primarily associated with the ability of ManTech to deliver the technology when needed. ManTech investments are currently focused on affordability improvements for: VIRGINIA Class Submarine (VCS)/OHIO Replacement (OR), DDG 51 Class Destroyer, CVN 78 Class Carrier, and, in a portfolio coordinated with the DOD and Air Force ManTech Programs, the Joint Strike Fighter (JSF) and the CH-53K Heavy Lift Helicopter.

Strategic planning for Navy ManTech is an ongoing effort. Navy ManTech annually analyzes acquisition scenarios and plans to determine major acquisition programs for potential investment. As the current platforms ManTech supports mature through their respective acquisition cycles, ManTech's investment targets change.

Although different in focus, scope, and size, ManTech's affordability initiatives function similarly. For each, ManTech has established an integrated process team or IPT with representatives from Navy ManTech, the platform Program Office, and representative industry. The IPT meets regularly to coordinate and review the portfolio and ensure that projects are completed in time to meet the platform's window of opportunity for implementation.

Individual Navy ManTech projects are developed in conjunction with industry and the acquisition Program Manager (PM). With their expertise in specific manufacturing areas, the Navy ManTech COEs play a key role in project definition. Planning for transition prior to the initiation of projects is critical for the implementation of technology on the factory floor and eventually into the Fleet.

Navy ManTech Investment Strategy

To clarify communication between program participants, Navy ManTech has established definitions for "transition" and "implementation". For Navy ManTech purposes:

- **Transition** denotes that point at which the ManTech project is completed and the technology meets customer (Program Office / industry) criteria / goals for implementation.
- **Implementation** denotes the actual use on the factory floor of ManTech results. (The resources for implementation are typically provided by entities other than ManTech including the Program Office and/or industry).

Agreements are reached on the degree of participation of the PEO/PM in support of the projects. The goal is for each PEO/PM to contribute resources to enable successful completion and implementation of the ManTech projects. Resources supplied may include financial support or cost share for the ManTech project itself or funding of Navy laboratory personnel to provide test, evaluation, certification, and/or other services. In addition, each PEO/PM is expected to provide personnel with technical expertise and/or management experience to assist the ManTech Program Office in project oversight. This support affords assurance that the weapon system PM is truly committed to the successful outcome of the ManTech project. In addition, this close working relationship between the parties provides ManTech with a longer-term view of implementation.

On a per-project basis, Technology Transition Plans (TTPs) document roles, responsibilities, and required resources needed to achieve transition and implementation. TTPs highlight the path from the technology development that ManTech performs to implementation on the factory floor. TTPs are signed by Navy ManTech, the relevant COE Director, a management representative of the industrial facility where implementation will occur, the Program Office, and, if appropriate, the Technical Warrant Holder. To assess progress, ManTech tracks the status of TTPs and conducts an annual assessment of transition and implementation.

In FY12, Navy ManTech expanded and formalized its focus on implementation and risks to implementation by instituting an Implementation Risk Assessment Management Process to assess potential future projects (those in the planning stages) as well as ongoing projects. For ongoing projects, risks are discussed during periodic Program Reviews to ensure ManTech is on the same page as the acquisition and industry stakeholders. For projects in the planning phases, the goal is to recognize risks to implementation upfront and, by doing so, prioritize funding of projects that have the greatest probability of implementing and have a real impact on affordability.

Semi-annual affordability assessments identify projected cost reduction / avoidance per project, as well as an estimated total ownership cost savings per platform. These assessments, verified by industry and the relevant Program Offices, provide critical information to ensure that ManTech can continue to meet both platform and ManTech affordability goals and are essential to the Program's success.

Navy ManTech Investment Strategy

While the large majority of annual ManTech Program resources are invested in accordance with the affordability investment strategy, Navy ManTech does support smaller efforts in Energetics and Repair Technology (RepTech).

Energetics: Energetics ManTech projects develop and transition process technologies for the synthesis of new or improved energetic materials, improved manufacture of propellants and explosives, and improved handling and loading of energetic materials into systems and components. Concentration is on developing solutions to ensure the availability of safe, affordable, and quality energetics products in support of Program Executive Offices such as Integrated Warfare Systems (PEO IWS/ IWS3C) and Conventional Strike Weapons (PEO (W)/ PMA 201). More information on Navy ManTech's Energetics Manufacturing Technology Center (EMTC) can be found on Page 11.

RAM-5 and existing production mixer

(Courtesy of EMTC)

RepTech: While the major emphasis of the Navy ManTech is on support of new production, ManTech also addresses repair, overhaul, and sustainment functions that emphasize remanufacturing processes and advancing technology. The RepTech Program focuses on fielded weapon systems and provides the process and equipment technology needed for repair and sustainment. Requirements for RepTech projects are driven by Navy depots, shipyards, Marine Corps Logistics Bases, intermediate maintenance activities, and contractor facilities responsible for overhaul and maintenance of Fleet assets. In general, RepTech projects are usually shorter in duration and are funded at lower levels than standard ManTech projects. The RepTech Program is run by the Institute for Manufacturing and Sustainment Technologies (iMAST). More information can be found on Page 12.

(Courtesy of iMAST)

Navy ManTech Execution

The Navy ManTech projects are executed through the Navy ManTech Centers of Excellence (COEs). The COEs were established as focal points for the development and transition of new manufacturing processes and equipment in a cooperative environment with industry, academia, and the Naval Research Enterprise.

The COEs:

- Execute projects and manage project teams;
- Serve as a corporate expertise in technological areas;
- Collaborate with acquisition program offices/industry to identify and resolve manufacturing issues;
- Develop and demonstrate manufacturing technology solutions for identified Navy requirements;
- Provide consulting services to Naval industrial activities and industry; and
- Facilitate transfer of developed technologies.

Descriptions of ManTech's seven COEs are presented on the following pages.

Composites Manufacturing Technology Center

The Composites Manufacturing Technology Center (CMTC), established in 2000, is located in Anderson, SC and is operated by ATI dba SCRA Applied R&D. The CMTC is a virtual center, providing expertise from across the defense industrial base to address all Navy composites manufacturing technology needs.

CMTC forms teams of prime contractors, composites industry suppliers, and universities and has strong in-depth knowledge and experience in composites manufacturing technology for all modern DOD weapon systems. As part of CMTC's organizational structure, all laboratories, facilities, and project labor resources are provided by project teams. This unique structure results in cost benefit to the Navy, with maximum funding going to project execution. CMTC's current portfolio includes composites manufacturing projects for four major ship platforms and the Joint Strike Fighter.

CMTC Web site: http://cmtc.scra.org

Electro-Optics Center

Since 1999, the Electro-Optics Center (EOC) has served as the ONR Manufacturing Technology Center of Excellence for Electro-Optics. The EOC's goal is to reduce acquisition costs, operational costs, and life-cycle costs while simultaneously improving mission capability of electro-optic military hardware and enabling transition of technology to industry and ultimately to the Warfighter. Since its inception, the EOC and the partner members of its Electro-Optics Alliance (EOA) have completed over 37 ManTech projects which have resulted in significant savings to the taxpayer. The purpose of the EOA is to advance DOD critical E-O Manufacturing Science and Technology and to promote U.S. preeminence in all areas of E-O. Alliance membership is available at no cost to all U.S. companies, government labs, and academic institutions involved in E-O technology. The EOA is committed to advancing the commercial viability of E-O technologies and promoting technology transfer to industry, as well as wide dissemination of new E-O related information.

The EOC, a proud part of The Pennsylvania State University, is a hybrid between the best components of a university and those of private industry. This relationship enables access to the university's researchers and scientists, its state-of-the-art facilities, and leading-edge research. EOC staff, comprised primarily of former industry and DOD personnel, brings experience in exceeding sponsor and corporate expectations. Through the application of this hybrid model, the EOC is able to provide its sponsors with solutions that combine leading

Navy ManTech Execution

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) was established in 1984 to aid the electronics industry in improving electronics manufacturing processes required in the manufacture of military systems. Today, the EMPF operates as a national electronics manufacturing COE focused on the development, application, and transfer of new electronics manufacturing technology by partnering with industry, academia, and government centers and laboratories to maximize available research capabilities at the lowest possible cost. The EMPF serves as a corporate residence of expertise in electronics manufacturing. The EMPF's principal goals are to: improve responsiveness to the needs of DOD electronics systems; ensure that deliverables make a significant impact in the electronics manufacturing industry; facilitate the development and transition of technology to the factory floor; and expand the customer base to a national level.

The EMPF operates in a modern 36,000 square foot facility adjacent to the Philadelphia International Airport. The facility houses a demonstration factory containing the latest electronics manufacturing equipment, fully equipped classrooms for skill-based and professional level technical training, and an analytical laboratory for materials and environmental testing. The EMPF offers many electronics manufacturing services and capabilities to the U.S. Navy, DOD, and the U.S. electronics manufacturing industrial base. The EMPF's resident technical staff consists of the nation's leading electrical engineers, mechanical engineers, materials scientists, chemists, physicists, instructors, and technicians. The EMPF staff is dedicated to the advancement of environmentally safe electronics manufacturing processes, equipment, materials and practices; flexible electronics manufacturing technologies; and workforce competency in electronics manufacturing processes, equipment, materials and practices; flexible electronics manufacturing technologies; and workforce competency in advanced electronics manufacturing.

EMPF Web site: http://www.empf.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC), established in 1994 by the Office of Naval Research (ONR), is Navy-operated and located at the Naval Sea Systems Command's Naval Surface Warfare Center, Indian Head EOD Technology Division (NSWC IHEODTD), Indian Head, MD. NSWC IHEODTD serves as the focal point for the Center and as a renowned leader in energetics, provides a full spectrum of capabilities. These include energetics research, development, modeling and simulation, engineering, manufacturing technology, production, test and evaluation, and fleet / operations support.

Energetic materials (reactive chemicals), formulations (propellants, explosives, pyrotechnics), and subsystem components (fuzes, detonators, boosters, igniters, safe & arm devices) are critical to the performance and reliability of weapon systems and thus to our Nation's defense. Applications include missile, rocket, and gun propulsion; stores or ordnance separation; warheads and munitions; obstacle and mine clearance; flares; decoys; fire suppression; and aircrew escape. Energetics, inherently dangerous, require special processes, equipment, facilities, environmental considerations, and safety precautions. At EMTC, this is kept in mind while ensuring the availability of safe, affordable, and quality

products. The Center develops solutions to manufacturing problems unique to military system / subsystem acquisition and production requirements and the energetics industry. The Center does not own or operate any facilities and equipment but is essentially a virtual enterprise that involves government, industry, and academia in identifying requirements and executing projects. EMTC objectives are to identify weapon system and manufacturing base needs, develop and demonstrate the required manufacturing process technology solutions, and transition successful results.

EMTC Website: http://www.navsea.navy.mil/Home/WarfareCenters/NSWCIndianHeadEODTechnology/WhatWeDo/EMTC.aspx

Institute for Manufacturing and Sustainment Technologies

The Institute for Manufacturing and Sustainment Technologies (iMAST), established in 1995, coordinates Navy ManTech efforts at The Pennsylvania State University's Applied Research Laboratory (ARL), one of five U.S. Navy University Affiliated Research Centers (UARCs). Located in State College, PA, iMAST's primary objective is to address challenges related to Navy and Marine Corps weapon system platforms in the following technical areas: materials processing, laser processing, advanced composites, manufacturing systems, repair and sustainment, and complex systems monitoring. iMAST supports the Navy and Marine Corps systems commands, as well as PEOs and Navy laboratories.

RepTech applies new and emerging technologies to improve capabilities of Navy depots, shipyards, Marine Depot Maintenance Command and lower level maintenance activities throughout the Fleet. RepTech cooperates and communicates with other Navy COEs, the joint depot community, DOD industrial activities, industry, PEOs, and university

laboratories.

iMAST Web site: http://www.arl.psu.edu/centers_imast.php

iMAST Cost-Effective Repair Technology and Improvements (Courtesy of iMAST)

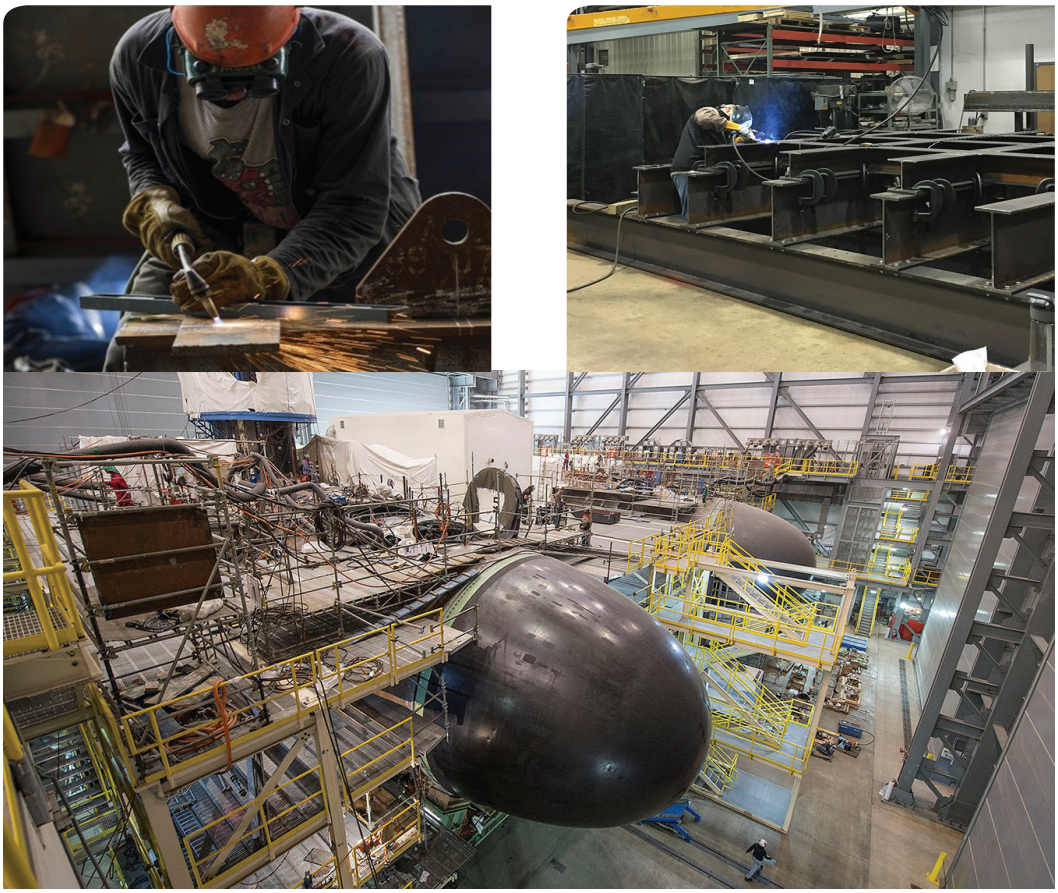
Navy Metalworking Center

For more than 25 years, the Navy Metalworking Center (NMC) has supported the Navy's evolving needs by developing and transitioning innovative metalworking and manufacturing solutions. To support the Navy's mission to reduce total ownership cost, NMC works with government and industry to develop and optimize metalworking and manufacturing processes and to implement the solutions in the U.S. industrial base. Currently, NMC conducts ship and air projects that incorporate advanced metalworking technologies, direct digital manufacturing, joining technologies, manufacturing process optimization, prototype tool development, advanced metrology and inspection technologies, and coatings application and removal.

NMC is operated by Concurrent Technologies Corporation, an independent, nonprofit, applied scientific research and development professional services organization located in Johnstown, PA.

NMC Web site: http://www.nmc.ctc.com

(Courtesy of NMC and Newport News Shipbuilding - A Division of Huntington Ingalls Industries)



Naval Shipbuilding and Advanced Manufacturing Center

The Naval Shipbuilding and Advanced Manufacturing (NSAM) Center develops advanced manufacturing technologies and deploys them in U.S. shipyards and other industrial facilities to improve manufacturing processes and ultimately reduce the cost and time required to build and repair Navy ships and other weapons platforms. This Center works closely with the Navy's acquisition community and the defense industry to address manufacturing technology issues that negatively impact efficiency, with respect to both cost and cycle time. NSAM solicits, selects, funds, and manages projects to address these critical and costly issues. The projects are focused on improving construction and repair processes, such as optimizing production practices, increasing the use of robotic manufacturing methods, investigating modular/packaged units, improving accuracy control, eliminating inefficiencies in material usage, and the using advanced manufacturing tools and technologies across the full range of DOD platforms.

NSAM and its predecessor, the Center for Naval Shipbuilding Technology (CNST), have been operated and managed by SCRA Applied R&D in Charleston, SC since 2003. Looking forward, NSAM will continue to pursue technologies focused on improving the affordability of current Navy acquisition programs. New projects being considered will investigate using modern planning systems, automated fabrication technologies, supply chain improvements, streamlined unit/module flow to and within storage and construction areas, wireless data management applications, using 3D product models to support production and developing improved scheduling systems for new, aggressive build strategies.

NSAM Web site: http://www.NSAMCenter.org

(Courtesy of NSAM)

Navy ManTech Technology Transfer

As previously indicated, the emphasis of the Navy ManTech Program is on transition of manufacturing technology that will result in tangible benefits for the Fleet. To achieve transition, it is imperative that the manufacturing advances be widely disseminated to the industrial base for implementation. To foster that dissemination, Navy ManTech provides the following:

Program Web site

The **Navy ManTech Program Web site** can be accessed at http://www.onr.navy.mil/mantech/. The Web site is a central source for accessing general information about the program activities and participation, developments and events, and key points of contact. The site also offers links to the online annual Navy ManTech Project Book, program success stories, as well as other publications and reports.

Defense Manufacturing Conference

The annual **Defense Manufacturing Conference (DMC)** is a forum for presenting and discussing initiatives aimed at addressing DOD manufacturing technology and related sustainment and readiness needs. The conference includes briefings on current and planned programs, funding, DOD initiatives, and seminars relating to the various technology thrusts currently being pursued. Further details are available at the DOD Manufacturing Technology Web site at: https://www.DODmantech.com.

Project Book

The **Navy ManTech Project Book**, published annually and available through the Navy ManTech Web site, is a snapshot of Navy ManTech projects active during that particular fiscal year. Points of Contact for each project are provided to facilitate technology transfer.

Centers of Excellence

The **Navy COEs** are focal points for specific manufacturing technology areas. The charter for each COE requires it to act as a consultant to both the Navy and industry and to facilitate the transfer of technology throughout the industrial base.

Navy ManTech Technology Transfer

The Navy urges government activities, industry, and academia to participate in its ManTech Program as participants, advisors, consultants and, most importantly, as beneficiaries. Development and implementation of new and improved technologies is achieved only through a concerted effort by everyone connected with the design, manufacture, and repair and sustainment of naval weapon systems.

For additional information on participation in the Navy's effort to strengthen the U.S. industrial base, impact platform affordability, and increase Navy readiness, contact any of the Navy ManTech Points of Contact listed on Pages 21-31.

(DDG 110 and CVN 74 - Courtesy of U.S. Navy)


VCS / OR

JSF


CVN 78 Class Carrier


DDG 51 Class Destroyer


CH-53K

Navy ManTech – affordability improvements for five key naval platforms: VIRGINIA Class submarine/OHIO Replacement (OR), Joint Strike Fighter (JSF), CVN 78 Class Carrier, DDG 51 Class Destroyer, and CH-53K Helicopter.

Navy ManTech's Affordability Objectives Addressed with SEWIP Lite

(Courtesy of U.S. Navy)

A Navy Project Team, consisting of the Navy ManTech Electronics Manufacturing Productivity Facility, Lockheed Martin Mission Systems & Sensors and PEO IWS, is enabling enhanced Electronic Warfare (EW) capability for both variants of the Littoral Combat Ship (LCS). In a previous Navy ManTech project, "Low Cost Antenna Assembly for the SEWIP Block 2" completed in April 2012, this team addressed critical manufacturing challenges associated with the upgrade of the Navy's AN/SLQ-32 EW system for large platforms such as aircraft carriers and destroyers. By leveraging the Scalable Electronic Warfare Improvement Program (SEWIP) Block 2 success, the team is demonstrating architecture scalability resulting in a SEWIP Lite system that exceeds the performance of the current LCS EW system at a reduced cost.

During the "Manufacturing Cost Reduction for LCS Scalable EW System" project, the cost effectiveness of applied advanced materials and pre-planned scalability though openness of architectural components has been demonstrated. A model of the reduced Block 2 system has been assembled and tested for compliance with technical performance measures. The result is a future-proofed EW system, upgradeable though detailed Government possessed data rights, and multi-platform scalability through modular building blocks. This project has enabled platform specific functionality, performance, and reduced size, weight, power and cost (SWaPC) requirements to be achieved with subassemblies common throughout the US Navy.

SEWIP Lite provides an EW system that meets LCS mission requirements and performance objectives at a cost savings of $1M per Block 2 system. By enabling commonality of the Block 2 EW hardware, the insertion of advanced technology results in a collateral benefit of cost reduction across all of SEWIP for the planned 127 ships (including DDG 51 and CVN 78). In full rate production, over $174M direct cost savings are projected. In addition, the U.S. Coast Guard will benefit from this effort because they have chosen to implement SEWIP Lite on the Offshore Patrol Cutters.

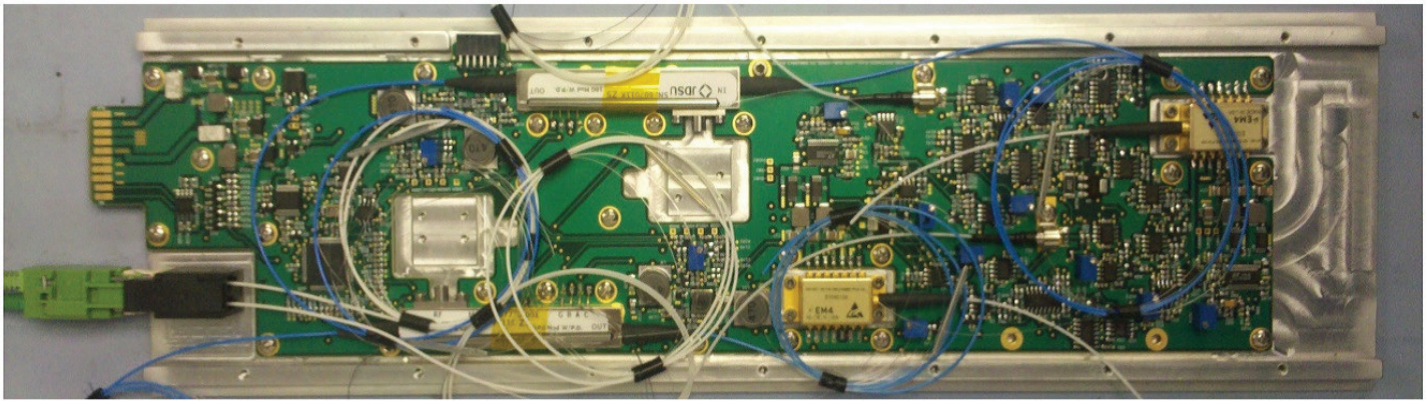
This Navy ManTech effort provided qualified SRU level hardware – enabling a direct integration path into the SLQ-32 (v)6. Changes to the Technical Data Package (TDP) were accomplished enabling the transition and implementation of the SLQ-32

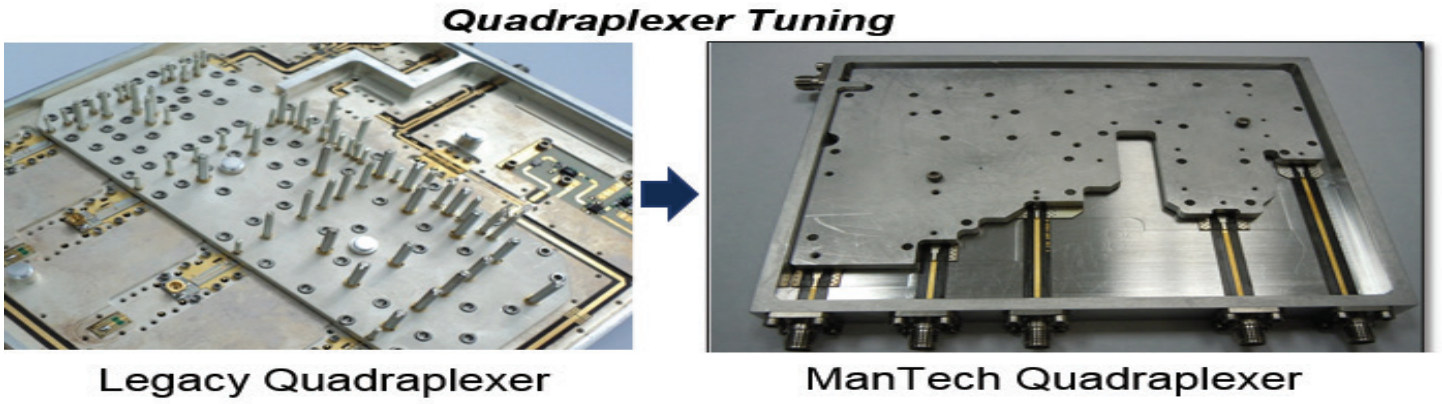
(v)6 system onto the DDG-51 and CVN.

Navy ManTech investment: $7.7M IWS investment: $2.5M

"The Navy ManTech office is proud of their technical contribution to the affordability improvements of the AN/SLQ-32 (v)6 and C (V)6. With anticipated acquisition savings of over $1.0M per ship set, and 95% component commonality between the AN/SLQ-32 C(V)6 and (v)6 systems, enabling reduced life-cycle costs for the fleet."

Richard Henson, EMPF Program Officer, ONR, 03MTAI (Sept. 2016)





(Courtesy of Electronics Manufacturing Productivity Facility and Lockheed Martin)

CVN 78 Class / Carriers Projects

Composite Hybrid Rotating Coupling Covers to Provide Life-Cycle Cost Savings for Aircraft Carriers

PERIOD OF PERFORMANCE:
September 2014 to July 2017

PLATFORM:
CVN Class / Carriers

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Jonathan Osborn
(864) 646-4508
Jonathan.osborn@ati.org

STAKEHOLDER:
PMS 378, PMS 312

TOTAL MANTECH INVESTMENT:
$1,215,000

S2532— Composite Hybrid Rotating Coupling Covers

Objective

Rotating Coupling Covers (RCCs) enclose shaft flanges on waterborne shafting on aircraft carriers. The existing fairings are doubly curved copper-nickel (Cu-Ni) with tight dimensional tolerances and therefore are difficult and expensive to fabricate. In addition, they have a history of leaking, as evidenced by extensive corrosion of the flanges. Following discussions with PMS 312, NAVSEA 05, and NSWCCD, the RCC concept in this Composites Manufacturing Technology Center (CMTC) project is a hybrid metallic/composite construction. The functions, shape, and arrangement of the individual components are to be determined during execution of the project, based on optimizing manufacturing processes, while reducing costs. As the primary structure the composite shells of the RCCs will be fabricated using methods developed for the fairwaters and rope guards, specifically male molding with OVB prepreg. A decoupled design is desired to eliminate the need for a watertight fairing seal.

Payoff

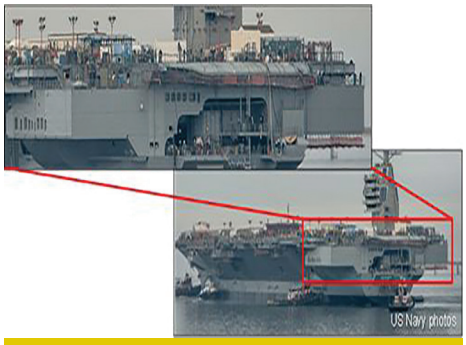
The principal benefit of this project will be life-cycle savings while reducing acquisition costs or remaining cost- neutral. The project is estimated to save $37M in total, resulting in an ROI of 25:1. The fabrication approach will save production time and, while the RCC is not on the critical path, any production time savings will be a risk reduction.

Implementation

This project will be demonstrated with PMS 312C funding on the earliest availability of a CVN 68 Class carrier. A RCC will be installed and checked after a limited time at sea. If successful, the composite RCC will be approved for use on all back-fits and future construction. The technical community will also leverage this preservation system to all surface ships, increasing the overall payoff for this effort. Implementation is estimated for FY17.

Enabling Earlier Outfitting Expected to Save CVN 79 Construction Costs

S2561 — CVN Vertical Build



Objective

The build strategy for CVN 78 required much of the ship outfitting activities to be completed in the dry dock, in areas that were difficult to access. Identifying outfitting activities that can be done earlier in the shipbuilding process can save significant construction costs. A Navy Metalworking Center (NMC) project team identified systems and specific construction areas of CVN 79 and future carriers that could benefit from pre-outfitting concepts, which improve construction efficiencies. The team also identified an approach that combines multiple items onto a common frame or foundation, creating one unit that can be constructed in the shop and then installed as a single, pre-tested item on the ship.

Payoff

Pre-outfitting will allow greater access for equipment and workers, and will reduce congestion and conflicting work and testing on hull after erection. Cost reductions are based on the 1-3-8 rule (shop/platen/post-erection construction costs). Two benefits analyses, using different methodologies, were utilized to project the benefits for the target area: Newport News Shipbuilding (NNS) analysis indicates a nearly $4M benefit and the NMC/Hepinstall analysis indicates a nearly $7M benefit.

Implementation

This project identified an area of the ship that would benefit from pre-erection outfitting and benchmarked the best practices of other shipbuilding programs and commercial industry to determine concepts that could be applicable to shipbuilding. Accomplishments include addressing issues that were encountered during construction of CVN 78 and the development of a sequence for outfitting spaces in the target area prior to erection, including complete outfitting of multiple berthing spaces on the Final Assembly Platen, a first for CVN construction.

Pre-outfitting of targeted areas has been implemented in the planning for CVN 79 construction. Work packages that reflect the new strategy are currently being implemented at NNS. Pre-outfitting construction for the targeted area will begin in the last quarter of this calendar year 2016.

PERIOD OF PERFORMANCE:
April 2014 to December 2015

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378, PMS 379

TOTAL MANTECH INVESTMENT:
$1,230,000

Creating the Ability to Quickly and Easily Analyze Material Impact on Build Strategy Decisions

PERIOD OF PERFORMANCE:
August 2014 to November 2016

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 378, 379

TOTAL MANTECH INVESTMENT:
$ 668,000

S2571 — Synchronizing Material Logistics with CVN Pier & Dry Dock Build Strategies

Objective

Naval ship construction is an immensely complex logistical activity involving large quantities of highly specialized material, equipment, and personnel. All material that ultimately resides in an aircraft carrier (CVN) must be pulled from inventory, staged within a limited footprint, and moved to the mechanic's work site along predetermined material paths. Material availability in the right job site at the right time is a key element in the Huntington Ingalls Industries - Newport News Shipbuilding (HII-NNS) drive to reduce CVN construction costs. Unnecessary movement of material, delays due to material unavailability or blocked material paths, or space consumed by unneeded material translate to schedule delays and increased costs.

The project's objective is to deliver a tool that will allow the material logistic controllers to manage the adjacent lay down areas in an optimal manner. The lay down areas next to the work areas need to be synchronized with the type of work currently underway with respect to required square footage and location. This project will provide an adaptive simulation tool capable of adjusting the material lay down layout and delivery path to the existing build strategies.

NNS is executing this project over two phases. Phase 1 addresses data and information collection and will quantitatively define the problems. During this phase, the project team will develop the general tool requirements, process, and procedures as well as conduct a phase review with a go/no-go decision gate. Phase 2 involves the development and testing of the simulation tool. The team will engage planners and material personnel in the use of the tool to obtain these end users' feedback. The initiative will be led by the Material Distribution Department supported by planning personnel representing all trades involved in dry dock construction (CVN 79).

Payoff

The CVN Construction Material Logistical Planning Tool will illustrate, by reports, how a specific build (construction or outfitting) strategy will impact material resources, thus allowing CVN management to determine the optimum plan chosen from several potential alternative plans each having been analyzed using the simulation tool. This technology, once implemented, could reduce lost trade time by over 28,000 hours and reduce CVN acquisition costs by an estimated $3.08M per CVN hull.

Implementation

The NNS team will develop a prototype simulation-based Material Logistics Planning Tool, employing discrete event simulation techniques, to create a library-based re¬usable application to optimize material logistic scenarios and improve the efficiency of CVN construction. The simulation tool will permit Ship Construction Production Control to quickly link a proposed build strategy to those material delivery logistics associated with the involved CVN tasks. Implementation is planned for late 2016.

Weapons Manufacturing Tie-down System Manufacturing and Installation Improvements Will Reduce Labor Hours and Cost

S2582 — Improved Weapons Magazine C-Channel

Objective

This Navy Metalworking Center project improved a labor-intensive process involved in the manufacture and installation of the Universal Weapons Magazine Tie-down System (WMTDS) on Navy platforms. Installing the deck channel (C-channel) involves considerable welding, grinding, leveling, and surface preparation. In addition, access is difficult when applying surface coating to the C-channels. This project reduced the overall installation hours and the associated costs to install the WMTDS. The Integrated Project Team (IPT) examined both Newport News Shipbuilding (NNS) and Ingalls Shipbuilding (Ingalls) installation processes and explored improved manufacturing and installation processes. The IPT developed, evaluated, and implemented several process improvement concepts.

Payoff

The estimated cost savings for this project are $5.5M over a five-year period on CVN 80, LHA 7 and LHA 8, and Ingalls-built DDG 51 class ships. Additional savings are possible on CVN 79. In addition to cost savings, the standardized WMTDS solution is expected to improve first-time quality and final preservation (surface coating).

Implementation

The IPT developed and evaluated several WMTDS improvement concepts including channel spacing changes, tolerancing changes, channel alignment fixtures, grinding improvements and painting improvements that are already, or soon will be, implemented at NNS and/or Ingalls. An automated welding system and revised primer system were also investigated for future implementation consideration. The IPT analyzed the selected improvements to ensure compliance with the structural system requirements, and constructed and evaluated prototype(s) to validate the process improvements. NNS and Ingalls requested approval from the Technical Warrant Holders and Program Offices to implement the improvements with supporting data generated from this project. Partial implementation has occurred on LHA 7 at Ingalls.

PERIOD OF PERFORMANCE:
January 2014 to April 2016

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378, PMS 379

TOTAL MANTECH INVESTMENT:
$1,500,000

Using Higher Deposition Submerged Arc Welding Processes to Increase Productivity

PERIOD OF PERFORMANCE:
June 2015 to June 2017

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$ $1,360,000

S2595 —High Deposition Submerged Arc Welding for FORD Class Aircraft Carriers

Objective

Compared to the previous class, FORD-Class aircraft carriers have been designed with larger quantities of thicker and thinner plating. These changes in plate thicknesses have negatively impacted fabrication costs by increasing welding hours and distortion, respectively. To achieve CVN 79/80 cost reduction goals, Newport News Shipbuilding (NNS) is actively working to improve its welding infrastructure. This includes selecting the optimal fabrication process so that the highest metal deposition rate processes, where appropriate, are qualified for production use. For example, submerged arc welding processes (SAW) have a higher deposition rate when compared to gas metal arc welding (GMAW). The NNS-led project will work to implement the use of higher deposition SAW processes and expand the use of SAW to increase productivity. The objective of this project is to support NNS's welding infrastructure improvement effort by piloting and validating advanced commercial SAW technology/equipment. Tied with other ongoing NNS efforts, meeting these technical objectives enables NNS to acquire new welding equipment to achieve the highest weld deposition for FORD-Class aircraft carrier fabrication.

Payoff

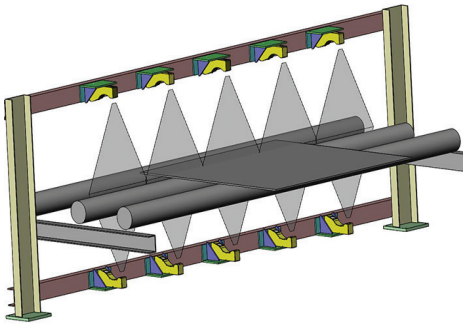
While the savings are based on a 30 percent improvement in deposition rate and an expansion of the use of high deposition submerged arc welding processes, this is the threshold value for success. The goal of the project is to increase the deposition rate by 50 percent, which would result in a greater savings. This technology could potentially save an estimated $3.38M per CVN hull.

Implementation

Implementation is expected to utilize a phased approach, where the most beneficial opportunities will be assigned higher priority and implemented first. The results of this ManTech project may be implemented in production of CVN hulls as early as FY17. However, the schedule for implementation activities is dependent on project results.

Implementing 3-D Inspection of Steel Plates Will Save Shipbuilding Costs

S2606— Efficient Identification of Plate Defects



Objective

Visual inspection of large steel plate surfaces to reliably detect critical surface flaws is a challenging task. Identifying defects as early as possible in the construction process has the greatest opportunity for cost savings. The Navy Metalworking Center (NMC) is conducting a project that will develop suitable three-dimensional (3-D) inspection technologies to reliably and repeatedly identify surface defects so they can be corrected to meet surface quality requirements before being fabricated. The Integrated Project Team (IPT) is focused on creating an inspection tool with speed, accuracy, repeatability, and durability for a shipbuilding environment.

Payoff

By implementing an inspection system at the pre-construction primer line prior to painting, Newport News Shipbuilding (NNS) is expected to reduce inspection and repair costs by $3.5M over a five-year period for the construction of CVN 78 class aircraft carriers. In addition, implementation of an inspection system at Ingalls Shipbuilding (Ingalls) is expected to result in a $650K savings over a five-year period on DDG 51 and LHA Class ships.

Implementation

The IPT is working with a metrology service provider, Custom Lab Software Solutions, to develop and modify a prototype automated visual inspection system that will be demonstrated in a production environment for expected use on CVN 80. Implementation is planned in August 2017 at Structural Coatings, a subcontractor to NNS. Secondary implementation is planned in 2018 for the pre-construction primer line at Ingalls in support of DDG 51 and LHA.

PERIOD OF PERFORMANCE:
August 2014 to May 2017

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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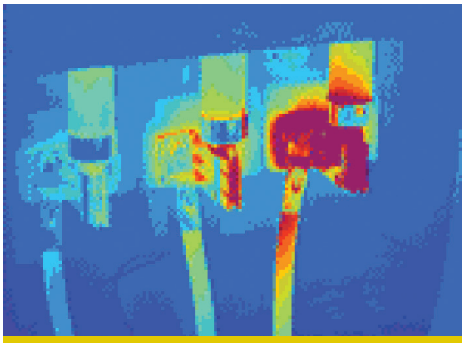
STAKEHOLDER:
PMS 378, PMS 379

TOTAL MANTECH INVESTMENT:
$1,403,000

Acoustical Sensing to Provide Safe Inspection of Energized Electrical Enclosures



PERIOD OF PERFORMANCE:
April 2015 to December 2016

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$ 650,000

S2643 — Acoustical Sensing through Energized Electrical Enclosures

Objective

An electrical fault diagnostic technology has been identified for energized shipboard electrical equipment and distribution panels. Early detection of electrical faults (e.g. loose connections inside the panels) will allow corrective actions prior to catastrophic failure (i.e., arcing, explosion, fire, etc.). Existing inspection procedures using Infrared Imaging Thermographic cameras require direct line-of-sight of energized components and electrical connections. This not only presents electrical safety hazards to personnel but also precludes inspection of switchboards all together with voltages of 450 VAC up to 13,800 VAC. Even if the enclosures are opened, obstructions and internal structures may block visual direct line-of-sight inspection of all energized components. Additionally, Infrared Thermography does not always detect the presence of Corona or tracking. A reliable, non-intrusive inspection technology is desired to provide electrical fault sensing of all energized equipment through closed panels. Ultrasonic inspection technology can provide a means of early fault detection and isolation, enabling planning of corrective maintenance actions, improve sailor safety, and increased asset availability. This project is being performed by the Institute for Manufacturing and Sustainment Technologies (iMAST) at the Applied Research Laboratory at the Pennsylvania State University.

Payoff

The new inspection technology promises to allow for easy and frequent inspections that can be performed through closed panels and under the preferred operational power loading thus enabling the early detection of electrical faults. This enabling inspection technology will allow proactive planning of corrective/preventive maintenance actions. Many electrical faults (loose connections/replaceable components) can be corrected with minor maintenance and minimal mission interruption. Acoustic inspection technology is applicable to all electrical distribution panels on all ship classes. An estimated $10M per year cost avoidance savings is expected to result from this project.

Implementation

Technology presented to the Applied Research Laboratory at the Pennsylvania State University will be evaluated within this ManTech project. Upon successful demonstration that this technology can detect faults reliably through closed enclosure doors and panels, implementation will be reviewed by the Technical Warrant Holder and funded through platform maintenance activities. Trial introduction of new technology is anticipated for 2017.

Targeting Cost Savings through Improved Metrology Standards

S2662 — Non-Contact Metrology in Shipbuilding

Objective

At Huntington Ingalls Industries – Newport News Shipbuilding (HII-NNS) optimization of the shipbuilding process is not only a focus, it is a requirement. If designing, constructing and providing worldwide fleet support for the Virginia Class Submarine (VCS) program was not enough of an undertaking, HII-NNS is also the sole designer and builder for the US Navy Aircraft Carrier programs as well. To be better equipped to keep up with the high demands of both the VCS and the Aircraft Carrier programs, HII-NNS has implemented a focus on improving the efficiency of traditional practices which provides opportunities for substantial cost reduction of both programs as well. One of the many methods of improving efficiency and reducing cost is by shifting much of the workload to earlier in the construction process. This will allow for the construction and fabrication of key components to happen in the shop, where modifications can easily be made, rather than in the difficult work environment onboard the ship. To facilitate this type of workload adjustment, precise measurements are required to ensure that the components fabricated in the shop meet the stringent specifications of the ship. Though the industry has been able to produce high quality vessels utilizing traditional metrology methods, constantly changing build plans contribute to the need of maintaining and utilizing the top-of-the-line metrology equipment.

This project, led by HII-NNS, is focused on identifying standards for integrating laser scanning and projection technology into product lines, and providing Standard Operation Procedures (SOPs) for their utilization at HII-NNS. By providing a clearly defined integration process and detailed procedures of how to best apply and the benefits of emerging technologies, HII-NNS will ensure the efficiency and accuracy of each metrology, and ultimately each construction process. The project will be conducted in two phases, with Phase 1 consisting of the identification and definition of process requirements, an initial pilot of the legacy process for gap identification, and the identification of suitable applications for non-contact equipment. Phase 2 will include the development of the various standards used to govern the use and application of various non-contact metrology equipment and a final pilot to verify the applicability of those standards.

Payoff

The improved guidance provided by the new standards is anticipated to result in an estimated $920K savings per CVN hull and an estimated $385K savings per VCS hull. Additional savings are anticipated be realized through implementation of the standards starting with the construction of the first Ohio Replacement Submarine in 2019.

Implementation

The project will develop standards to govern the use and integration of non-contact metrology technology to the ensure efficiency and accuracy of non-contact metrology evolutions. Upon completion of the final piloting evolution, NNS expects to implement the formal standards into the production environment with full implementation expected on CVN 79 during FY18.

PERIOD OF PERFORMANCE:
February 2016 to August 2017

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 379

TOTAL MANTECH INVESTMENT:
$408,000

DDG 51Family Projects

MK-99 CW Illuminator Transmitter Upgrade Meets Navy's Need for Reliable, Affordable Solid-State Replacement for Tube-Based System

PERIOD OF PERFORMANCE:
June 2012 to January 2019

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMS 500, LPD 17, IWS 1.0

TOTAL MANTECH INVESTMENT:
$7,435,000

S2385— Continuous Wave Illuminator Transmitter Upgrade

Objective

The Radar Transmitter used in the AEGIS MARK 99 Fire Control System (FCS), operates in conjunction with other components within the FCS to provide radiated energy for semi-active homing of the assigned missile. The transmitter contains equipment for generating and amplifying the stable Continuous Wave (CW) microwave signal to the required output power level. The current design for this transmitter is based on Traveling Wave Tube (TWT) technology, and has resulted in an unacceptably low Mean Time between Failure (MBTF) which has adversely affected both combat readiness and support costs for the Arleigh Burke (DDG 51) class of AEGIS destroyers.

The objective of this ManTech project is threefold. The first objective is to develop a solid-state transmitter that will provide the Navy with a higher availability, lower cost-of-ownership open architecture MK 99 Illuminator Transmitter that allows upgrades for new technologies and capabilities over the lifetime of a naval program. The second objective is to develop and implement new manufacturing technologies in critical subassemblies to reduce system cost. The third objective is to ensure continued production cost affordability to the Navy.

Payoff

Benefits include: (1) Improved Acquisition and Life-Cycle Costs: Analysis of the design associated with this ManTech effort concludes that the backfit-compatible GaN-based MK 99 transmitter upgrade will result in a 50 percent reduction in acquisition cost ($2M target) and greater than 39X improvement in Mean Time Between Critical Failure (MTBCF); (2) Reduced Time to Field: Open Architecture accommodates the easy spiral insertion of evolving Solid State Power Amplifier (SSPA) and power supply technology. Open Software and Hardware Architecture supports the rapid technology refresh and increased performance. This supports future cutting-edge COTS technologies including analog devices, processors, accelerators, etc.; and (3) Reduced Risk and Affordability Assurance: Evaluation of potential alternate COTS devices through simulation of the SSPA will reduce the risk associated with a single source of supply for the GaN-based X-band Power Amplifier MMIC contained in the SSPA Modules and ensure continued production cost affordability to the Navy.

Implementation

The ManTech transition event will occur with the successful completion of Design Verification Testing of the Engineering Design Model (EDM) at the Raytheon facility and the delivery of the EDM hardware, software, associated special test equipment and the Technical Data Package. The completion will also demonstrate the operational success of the upgraded CW Illuminator Transmitter. At this point, the decision will be made by IWS-1 to proceed with the separately-funded Qualification Test and Limited Rate Initial Production phases of the program.

Solid State Switch for Improved Reliability and Lower Acquisition and Life-Cycle Costs for DDG 51

S2485 — Solid State Switch Assembly for the AN/SPY -1D and (D (V) Transmitter

Objective

The Solid State Switch Assembly (SSSA) Navy ManTech project objective was to develop an upgrade for the AN/SPY-1 transmitter. This will enable the Navy to forward-fit and retrofit 72 DDG 51 class ships from the existing switch tube modulators to a solid-state switching system. Leveraging Raytheon's microwave experience in tube modulator design and Office of Naval Research (ONR)'s development of high-powered solid-state materials was the goal of this effort. The implementation of a solid-state switch provides improved reliability and lower acquisition and life-cycle costs. This was achieved while meeting the performance requirements needed to switch the Cross Field Amplifiers (CFAs) on the AN/SPY-1D and D (V) Radar. The primary function of the modulator is to deliver 18kV, 23 Amp pulses to the CFA.

In short, this project's primary development effort was to increase the current reliability of both the CFA and Final Power Amplifiers (FPA) tubes by replacing the switch tube modulator with a solid-state system that increases the mean time between failure (MTBF) while substantially reducing the cost of replacement and maintenance on the AN/SPY-1D transmitter

Payoff

Implementation of the SSSA for the SPY-1 radar is expected to result in a reduction to both the acquisition cost (40 percent cost reduction) and the life-cycle cost (60 percent cost reduction) of the Switch Modulator Drawer. This approach allows for a significant (4x) improvement in reliability over the present vacuum tube technology and can implement in a relatively short time. The solution will apply to the new build of DDG 51 Flt IIA Destroyers and retrofit onto existing DDG 51 ships. This approach could also be used on other radar platforms that utilize the AN/SPY-1 radar systems such as CG 47 Aegis ships.

Implementation

The project will be implemented utilizing two concurrent paths. The major portion of the project will focus on the design, development, and assembly of the SSSA, and will perform design verification testing on a full-scale engineering development model of the SSSA for the AN/SPY-1D and D (V) transmitter FPAs. SSSA tests will ensure that they enable the AN/SPY-1D and D (V) CFAs and FPAs to meet all performance requirements.

Eventually, though not part of this effort, the SSSA will be included in LRIP/ Production of the qualified FPA modulator decks. It is the goal of the Navy to forward-fit the SSSA in the current DDG 51 ship class build program, as well as back-fit retrofit on all DDG 51 class ships. Forward- and back-retrofit totals could potentially reach a total of 72 shipsets, three (3) Land land-based test sites, and spares.

PERIOD OF PERFORMANCE:
December 2012 to May 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMS 500
IWS 2.0

TOTAL MANTECH INVESTMENT:
$5,134,000

Improving the Yield of SiC High Efficiency Power Switches

PERIOD OF PERFORMANCE:
September 2013 to November 2017

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 500 & PMS 378

TOTAL MANTECH INVESTMENT:
$4,960,000

S2489 — SiC High-Efficiency Power Switches Wafer Process Improvement

Objective

Navy platforms continue to improve their performance and capabilities by insertion of new technologies, which ultimately require additional energy. High Efficiency Power Switching (HEPS) devices provide higher energy densities thereby providing additional power without requiring ever larger footprints. Under this four-year effort, the production yield of 6.5kV and 10kV SiC MOSFET's will be increased by transitioning from production on 100mm SiC wafers to 150mm wafers and design optimization. Eight design iterations will be completed under this effort to optimize doping levels and dimensions of critical features of the device. Device yield is expected to improve from 20 percent to greater than 60 percent, and the acceptable amount of power that can be switched is expected to double.

This project is one of Navy ManTech's Manufacturing Science and Technology projects which typically don't meet all of ManTech's normal project criteria as they are higher risk projects with longer transition timelines.

Payoff

There are many current and future Navy platforms that will be able to take advantage of this technology. Current costs are in the range of $100/Amp for these switches. It is expected that costs will be reduced to approximately $20/Amp at the end of this project. Navy personnel are engaged in an effort to estimate the number of switching devices the Navy will consume in the near future once this technology is transitioned to a commercial product and to identify platforms that will be first users of this technology.

Implementation

CREE has demonstrated the ability to implement their technology into a commercial device by commercializing 1.2kV SiC MOSFET's. CREE continually performs market research to determine the power needs of the both commercial and DOD sectors. Using previous trends in power requirements, CREE believes the market will require a commercial product in 1-2 years. At that time, CREE will lock down a design with specific power ratings and begin the transition from prototypes to commercial product.

Ingalls Pursuing Digitally Agile Strategy with Machine Readable Material Transactions

S2544 — Machine Readable Material Transactions

PERIOD OF PERFORMANCE:
June 2014 to June 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 500, PMS 400

TOTAL MANTECH INVESTMENT:
$1,520,000

Objective

Receiving material in the warehouse and tracking its movement throughout the yard was a paper laden, manually intensive effort. The data for each material transaction had to be manually keyed into the system by warehouse office personnel. This manual entry of data created a lapse of time between the time a material action was performed to the time it took the paperwork to return to the analyst for data entry into the system. As the material location moved out of the warehouse, the visibility of the material in the system significantly decreased. The lag time between issue of the material and completion of the paperwork for data entry resulted in material being "reallocated" to another platform, which lead delays in contractual accounting. The project's objective was to demonstrate cycle time reduction of material transactions using "machine readable" data entry with mobile scanning devices.

The introduction of an automated tracking system at Huntington Ingalls Industries – Ingalls Shipbuilding allowed for cycle-time reduction of material transactions for DDG 51 destroyer production. This facilitated traceability and accountability of material transactions from Receipt Inspection through ship installation, checkout, and delivery to the end user.

This was a two-phased project with the first phase consisting of developing the Receiving and Material Tracking modules. The project successfully completed Phase 1 and transitioned into Phase 2 where developing the sequentially linked Inventory, Maintenance, and Material Consumption modules were completed.

Payoff

This implemented technology has reduced material processing time and reduced annual material losses and will result in a $2.9M cost savings per hull. This technology provided an increase in accuracy and reduced cycle-time of material transactions, ensure visibility, traceability, and accountability for all material from receipt through delivery to the customer. It has also improved quality inspection and preventive maintenance processes, and reduced the equipment transaction processing time.

Implementation

Upon completion of each phase, Ingalls supplied mobile devices to warehousemen, storekeepers, foremen, etc., working the fabrication of DDG hulls as well as current and future programs. These employees began using the mobile devices as the standard method of material receiving, issuing and tracking. Processes and procedures were updated to support utilization of handheld devices for material tracking. The system was partially implemented in a production environment during the first quarter of FY16 and fully implemented third quarter of FY16.

Ingalls Perfecting Unit Lay-Down Planning with Capacity Planning Automation

PERIOD OF PERFORMANCE:
June 2014 to December 2015

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 500, PMS 400

TOTAL MANTECH INVESTMENT:
$1,106,000

S2554 — Capacity Planning Automation

Objective

Lay-down placement and assignment of units through successive shipyard work stations at Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) was done through a laborious, manual process. Approximately 30 percent of previously planned units / assemblies required re-planning. Due to the large amount of complexity usually associated with large planning problems, this rework often required a complete reiteration of the entire real estate allocation process. Some software tools were in place, but they were not automated. Automating the real-estate allocation process saves time in capacity planning, provides savings due to better lay-down coordination, reduces excessive movement of units, provides higher confidence in capacity forecasting, and increases capacity planning process efficiency. An automated solution that enables (re)creating the real estate allocation in significantly fewer man-hours reduces the cost of performing the required processes. Ingalls Work Instructions define the processes and responsibilities for the proper allocation and optimization of real estate (lay-down spaces) for structural units and assemblies under construction while providing forward visibility for scheduled or potential overloads to capacity. The old capacity planning processes were tedious and overly time-consuming and resulting real estate allocations were seldom optimal and often required substantial rework. One of the achieved goals of the automated process was to develop a unit layout and schedule allowing the construction of as many units as possible under cover, versus outside.

The system uses an applied artificial intelligence in the form of a rules-based Expert-System to produce an efficient utilization of available lay-down real estate.

Phase 1 identified and defined needs and requirements and Phase 2 developed and deployed the system solutions. The project created an automated, flexible, rules-based expert system used in the allocation of lay-down space and the creation of real-estate utilization documentation. This unit lay-down planning advisor permits a scheduling analyst to rapidly assess multiple changes from the current allocation of units to lay-down areas, largely mitigating the weaknesses of the previous manual analysis method.

Payoff

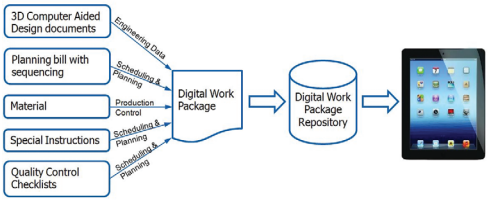
This implemented technology is expected to exceed its target to reduce real estate allocation processing time by 30 percent and increase in number of units constructed under cover by 20 units. Reports indicate activities historically taking 10 weeks to complete are now completed in less than one hour. The estimated cost savings are expected to exceed $990K per year.

Implementation

Ingalls deployed the solution in its target environment after acceptance testing and based user feedback. The new AREAS tool was so well accepted that it has been placed in a full production environment and all Capacity Planning is now done with this new tool. The results of this ManTech project have been implemented in production of DDG 51 ships and will directly show benefits on DDG 119 and all future hulls.

Ingalls Providing Real-Time Electronic Construction Information via a Digital Workpackage to Craftsmen for Construction

S2569 — DDG Digital Storyboarding



Objective

Historically, at Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls), the ability to convey digital information to the deck plate craftsman was either nonexistent or very limited in applications. The amount of digital data in shipbuilding has increased significantly throughout engineering, planning, manufacturing, training, etc. There existed a need to migrate off paper dependency and provide digital information to the deck plate in real time.

This project developed the process and produced a pilot demonstration for providing a digital work package to the craftsmen for construction. The digital storyboard solution reduced the duration of the current paper-based processes by eliminating the conversion of digital data to paper and any other associated delays. The craft will have access to current engineering design information through the implementation of Digital Work Packages. The Digital Work Package includes: product sequence and assembly visualization, manufacturing instructions, material lists, quality control checklists, any other special instructions or related information, and are provided to work package consumers electronically on a mobile device.

Payoff

The creation of digital storyboards as a means of providing real-time electronic construction information has wide applications throughout the shipbuilding industry. The ability to move data digitally between organizations in the design, planning, and construction cycles decreases total cycle-time and increased process efficiency. In addition, it facilitates a rapid response to the engineering change process, reduces frequency and size of waterfront changes, and provides an improvement in build schedule. This fully implemented technology is expected to exceed its target to reduce electrical outfitting man-hours an estimated cost savings of $2.93M per DDG hull.

Implementation

As the Digital Work Package was executed, an equipment time study was performed to capture duration and field feedback. This information was compared to historical data and a cost savings assessment generated. As part of the project tasks, a business case analysis was conducted to document various labor costs including vessel labor time and process improvements. The Ingalls Project Team obtained approval by both Operations and Planning for suitable Digital Work Package to be implemented and are in the process of implementing the system. The results of this ManTech project were vetted during pilot testing and full implementation is due for completion in 2017 on DDG 125.

PERIOD OF PERFORMANCE:
July 2014 to December 2015

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 500, PMS 400

TOTAL MANTECH INVESTMENT:
$754,000

Implementation of DDG 51 Sonar Dome Manufacturing Improvements

PERIOD OF PERFORMANCE:
October 2013 to February 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 400D
PMS 500
PEO (Ships)

TOTAL MANTECH INVESTMENT:
$2,139,000

S2579 — Sonar Dome Fabrication Process Improvements

Objective

This Navy Metalworking Center project has streamlined current processes and procedures to fabricate the Aegis Destroyer (DDG 51 class) sonar dome, which has a complex geometry and is challenging to construct. The Integrated Project Team (IPT) investigated metrology solutions as well as mechanized material removal technologies, which will improve the current manual processes. The project results reduce the time, labor, and rework associated with fabricating and assembling the sonar dome at Ingalls Shipbuilding (Ingalls).

For material removal tasks, the IPT developed, enhanced and tested several material removal technologies that increased the efficiency of the current process. Specifically, the team developed and pilot tested a portable grinding station consisting of a mechanical arm and versatile mounts for various conditions. Additionally, the project team demonstrated a plasma gouging system as a rapid material removal solution. For the metrology tasks, the project team investigated and recommended implementation of a laser scanner system to perform plate check verification to reduce or eliminate rework prior to installation. The IPT also developed a specialized measurement plan that automated the post-processing of scanned data. The team demonstrated this technology at Ingalls in January 2016.

Payoff

The project results reduced labor to fit and assemble DDG sonar dome components by 23 percent, structures across other DDG process areas by 6 percent, and structures across Amphibious Assault Ship (LHA) and Amphibious Transport Dock (LPD) process areas by 18 percent; saving $7.6M over five years on platforms constructed at Ingalls. Additionally, the project results will benefit the construction of National Security Cutter (NSC) hulls under construction at Ingalls. Beyond the quantified project savings, process improvements will also improve environmental, health and safety conditions for employees.

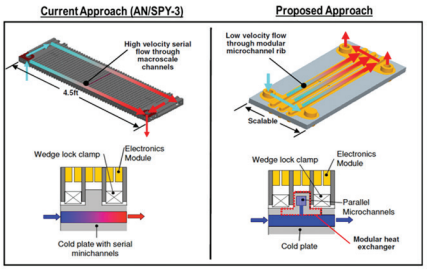
Implementation

The prototype technologies were designed, tested and iteratively improved as part of this project. NMC demonstrated and Ingalls pilot tested the technologies with in the shipyard on production articles to support validating the project business case. Upon successful demonstration of the prototype technologies developed on the project, NMC transitioned ownership of the prototypes, as well as any tooling and test fixturing from ONR to PMS 400D for use at Ingalls in production.

Ingalls initiated full-scale implementation activities by procuring several additional mechanical grinding stations, air plasma gouging systems and the laser scanner. Full implementation is expected in late 2016. Bath Iron Works, Portsmouth Naval Shipyard and BAE Systems – York also expressed interest in the project results.

New Manufacturing Approach Utilizes Friction Stir Welding to Improve Fabrication of Electronics Cold Plate Assemblies

S2590 — Modular Scalable Cold Plates for Naval Electronics



Objective

Thermal management of edge-cooled naval electronic assemblies presents unique performance and manufacturability challenges to system designers. Current manufacturing approaches for the fabrication of cold plates are supplier limited, resulting in low product yield and high costs due to difficulties associated with brazing large, monolithic, highly complex assemblies. The Navy Metalworking Center led an Integrated Project Team (IPT) to develop friction stir welding (FSW) processes to join modular heat exchangers to form a larger cold plate assembly based on a system designed and developed by Raytheon Integrated Defense Systems. The use of FSW provides lower distortion, improved weld strength and quality, and improved overall system affordability. This project fabricated and demonstrated a modular cold plate assembly with lower distortion that reduced part rework, scrap, and cost; improved weld strength and mechanical properties; and reduced cold plate acquisition cost.

Payoff

Cost savings are estimated to be $387K on DDG 1002. Additional $300K/hull savings is possible for DDG 51 Flight III (each incorporating four AMDR-S radar apertures) and $880K/hull for DDG 51 Flight IIIA (each potentially incorporating three or more AMDR-X and four AMDR-S radar apertures).

Implementation

In addition to DDG 1002, implementation opportunities are being pursued by Raytheon, such as Enterprise Air Surveillance Radar (EASR), Enterprise X-Band, and Missile Defense Agency (AN/TPY-2). Implementation is targeted for DDG 1002 (two of the three array faces) after a second generation prototype is completed.

PERIOD OF PERFORMANCE:
April 2014 to March 2016

PLATFORM:
DDG 51 / DDG 1000

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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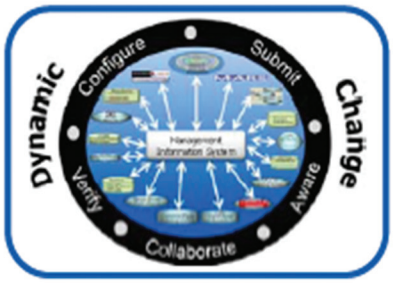
STAKEHOLDER:
PMS 500
PEO IWS 2.0
NAVSEA

TOTAL MANTECH INVESTMENT:
$1,054,000

Ingalls Pursuing a Real-Time Production Change Awareness Process



S2594 — Dynamic Change Awareness

PERIOD OF PERFORMANCE:
December 2014 to December 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 500
PMS 400

TOTAL MANTECH INVESTMENT:
$1,661,000

Objective

A lack of visibility and knowledge of forthcoming changes to design or planned work increases engineering labor, planning labor, and production rework. Foremen spend significant effort in generating plans, confirming location of materials, and training personnel on scope of the job, frequently reworked because engineering or planning departments may have changed details and impacted the foremen's plan. When these changes finally make it to the production area, work progress is impacted, now out of sequence, or stopped altogether. The craftsmen frequently expend time locating missing material, removing items already installed, and/or repairing shipboard items before the change can be executed. Inefficient change management processes between engineering, planning, and the supply chain results in lost production man-hours, thus increasing the cost of fabricating the DDG Class destroyer.

This project is being conducted in two phases covering 24 months at Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls). The results of this project will provide identification of baseline process gaps for engineering and planning organizations specifically seeking reduction in process time. The project team will develop a real-time process for seamless communication between engineering, planning, supply chain management, and production control organizations. Ingalls will also create 'dashboard' status views for engineering, planning, supply chain, and production control.

Payoff

A real-time process and dashboards will reduce duplication of efforts and reduce the errors in material ordering which could eliminate as much as 10,000 man-hours per DDG hull in this area alone. The project's output will provide critical capabilities to the Ingalls organization such as: (1) product data change management and change information aggregation; (2) 3D visualization of change data; and (3) collaboration on change development, administration, validation, and approval.

This implemented technology is expected to reduce hours associated with engineering rework by more than 29,000 hours and reduce the amount of incorrectly ordered material by 2.5 percent, equating to a cost savings of $3.3M per DDG hull.

Implementation

During Phase 2 of the project, Ingalls will develop the envisioned dashboards, pilot the real-time processes, and develop the full production implementation strategy. The Ingalls team expects to deploy the solution in its target environment after initial acceptance tests are complete and engage affected individuals, groups, and organizations to ensure the solution satisfies documented needs and expectations. The results of this ManTech project will be vetted during pilot testing and are slated for implementation in mid-2017 on DDG 127.

Capacity Planning Tools Transitioned to BIW

S2600 — Shipyard Capacity Planning Tools at BIW

Objective

Capacity planning is the process of ensuring that production capacity is matched to demand. Capacity planning enables facilities to meet critical delivery schedules at minimized costs. Bath Iron Works (BIW) has legacy production information systems that can be used to facilitate more robust capacity planning analyses. However, the capabilities of these tools are not fully exercised due to significant upfront customization of the systems to meet initial implementation requirements that limits their analysis capabilities. In addition, planners often employ a plethora of "tools" (spreadsheets, databases, etc.) to understand the demands on resources such as labor, machines, fixtures, or space under their control. Therefore, there are increased chances of disparate plans being developed that are not efficiently synchronized to the master production schedule.

The objective of this Navy ManTech Institute for Manufacturing and Sustainment Technologies (iMAST) project is to develop a shipyard-wide capacity planning system that enables the BIW planning organization and construction management personnel to conduct both long-term shipyard-wide and short-term, shop-level capacity planning for critical shipyard resources in support of their DDG 51 and DDG 1000 shipbuilding programs. Specifically, this project will develop a central data system, long-range and shop-level capacity planning tools, and integrate the previously transitioned Spatial Scheduling Tool into the system

Payoff

The implementation of the capacity planning tools at BIW is expected to result in a reduction of overtime trade-labor hours and a reduction of labor hours for production planning and control personnel. The Capacity Planning System will speed up the time to develop capacity plans and enable rapid mitigation when existing plans require modification. BIW projects the savings for production and planning personnel to be an estimated $921K per hull (5 hulls), resulting in a five-year ROI of 6.36:1

In addition to the quantitative benefits, qualitative benefits are expected to include improved visibility of potential space conflicts in advance of production, reduced non-value-added product movement, and completion of work in preferred work locations.

Implementation

The Spatial Scheduling and Long-Range Shop-Level Capacity Planning tools have been implemented in production at BIW, where immediate savings in planning development time and improvements in planning fidelity have been reported by the planning organization. The prototype Shop-Level Capacity Planning Tool was delivered to BIW for testing; additional software development will be based on end-user feedback. The full-scale Capacity Planning System is expected to be implemented in production at BIW in December 2016.

PERIOD OF PERFORMANCE:
July 2014 to January 2017

PLATFORM:
DDG 51 / DDG 1000

AFFORDABILITY FOCUS AREA:
Automated Tools
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 400D
PMS 500

TOTAL MANTECH INVESTMENT:
$730,000

Improvements in Ship Stiffener Manufacturing to Reduce Shipbuilding Labor Costs

PERIOD OF PERFORMANCE:
July 2014 to October 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500
PMS 400D

TOTAL MANTECH INVESTMENT:
$1,311,000

S2604 — Shape Cutting and Welding Automation

Objective

The Navy Metalworking Center (NMC) led a project to improve the stiffener fabrication process for several surface ships. Ship frames are comprised of I-beam stiffeners that are manually cut and welded to various shapes, lengths, and geometries, according to the ship design. Workers manually lay out the stiffeners, cut them with oxy-fuel torches, and then fit and weld attachments and protrusions to them. An NMC-led Integrated Project Team (IPT) characterized the current causes of inaccuracies and inconsistent quality of these fabricated stiffeners; developed process improvements; and developed tooling and prototype equipment to improve the stiffener manufacturing process, including improved forming processes to increase part accuracy and consistency.

Payoff

The project's solutions will reduce labor and rework, and increase accuracy and throughput, significantly lowering costs and improving the production schedule for this operation. The automated technologies used to improve stiffener fabrication will be implemented at Ingalls Shipbuilding (Ingalls) and are expected to save $5.5M during a five-year period across several platforms in labor and material savings alone.

Implementation

The IPT developed prototype systems and tooling that will be tested for functionality and efficiency at the Ingalls stiffener fabrication area. The project results will be implemented at Ingalls in support of LHA, LPD, and DDG 51, as well as the Coast Guard's NSC, starting in the second quarter of FY17.

ManTech Project to Demonstrate Additive Manufacturing Benefits for Ship Construction

S2608 — Additive Manufacturing for Shipbuilding Applications

Objective

Recent advancements in three-dimensional (3-D) manufacturing technologies, including computer-aided design, scanning technologies and 3-D printers, have resulted in a new generation of manufacturing technology commonly referred to as additive manufacturing (AM). AM is rapidly becoming a versatile tool in the manufacturing industry as the cost of acquiring and implementing the technology decreases. Of particular interest to shipyards is using AM to make tools, such as jigs, fixtures, drill and alignment guides, and other manufacturing aids to improve efficiencies and responsiveness in the shipbuilding process. Typically, such tools consist of low-quantity parts that are custom designed and often machined from aluminum or other metals, which can be expensive and time consuming. Ingalls Shipbuilding (Ingalls) and General Dynamics Electric Boat (GDEB) are interested in employing AM within these areas, as well as other potential shipyard processes, not only to realize the cost and time benefits of the technology, but also to improve first-time quality during ship construction. The Navy Metalworking Center-led project has successfully demonstrated AM as a viable technology for producing manufacturing aids, prototypes, and assorted tools and end-use products for the ship production environment.

Payoff

GDEB has estimated a minimum acquisition cost savings of $213K per VCS hull by using AM technology to rapidly deploy new tooling/fixtures.

Implementation

Implementation will occur at Ingalls pending commitment of capital funds to purchase a polymer printer. The GDEB Quonset Point facility intends to expand its printer capability laterally (i.e., purchase multiple identical desktop printers for increased volume and availability). Implementation is planned in FY 17 at Ingalls on DDG 121, LHA and all future surface combatants after technology insertion. Implementation is planned in FY16 for GDEB on SSN 794.

PERIOD OF PERFORMANCE:
October 2014 to June 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500, PMS 400D
PMS 450,

TOTAL MANTECH INVESTMENT:
$820,000

Work Cell Principles and Work Flow Improvements Will Reduce Ingalls Shipbuilding Costs

PERIOD OF PERFORMANCE:
January 2015 to March 2017

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Automated Tools
Metals Processing & Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$1,428,000

S2612 — Automated Manufacturing Cell for Small Repetitive Assemblies

Objective

The Navy Metalworking Center (NMC) is conducting a ManTech project that will improve efficiency at the Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls) Industrial Products Division (IPD) shop -which fabricates hundreds of relatively small, high-volume parts per ship, mostly through manual labor at individual stations throughout the facility. Applying work cell principles and planning, mechanization, and automation to the manufacture of parts such as ladders, railing, aircraft tie-downs, manhole covers, and lifting lugs will allow products to be produced more efficiently and improve part quality resulting in reduced costs.

Payoff

The anticipated savings will be realized by a significant reduction in the manual labor to produce these assemblies, along with improved material handling and ergonomics, and the reduced rework associated with implementing a mechanized / automated manufacturing work cell. Implementation of the project results is estimated to result in an annual savings of $1.5M across all platforms constructed at Ingalls, i.e., DDG 51, LHA, LPD, and NSC.

Implementation

The Integrated Project Team (IPT) evaluated current processes in the IPD shop and then selected part families and associated processes to target for automation / mechanization. NMC and Ingalls established work cell requirements used to develop concepts to mechanize the fabrication of the target part families and focus areas. The project team down-selected several of these initial concepts and is further developing them to demonstrate the manufacturing cell benefits. The team is developing flexible fixtures to fabricate various part families and is mechanizing processes such as stud welding as well as part forming and hole punching. In addition, the IPT is investigating the implementation of a work cell approach where manufacturing processes are co-located to improve material handling efficiency. The results of this project are expected to be implemented beginning in the second quarter of FY17.

Adapting Existing Robotic Welding Systems to Save Manufacturing Costs for Large, Complex Structures for DDG 51

S2636 – Robotic Welding of Complex Structures

Objective

Traditional manual welding processes used to fabricate innerbottoms and other large complex ship structures are labor intensive and can be ergonomically challenging. The Navy Metalworking Center is leading a ManTech Integrated Project Team (IPT) to develop and demonstrate a system to rapidly instruct existing welding robots on welding path locations for as-built structures and to execute welds in complex assemblies. The IPT is investigating several robot-mounted sensing systems for use on these structures. The IPT will develop and demonstrate a prototype system that integrates the necessary hardware and software to be able to semi-autonomously locate the weld seam, position and orient the welding head, and execute a suitable weld.

Payoff

Large-scale implementation of robotic welding at the DDG 1000 peripheral vertical launch system (PVLS) cell is estimated to produce $5.6M savings for the DDG 51 class at Bath Iron Works (BIW) over five years as a result of labor and material savings and schedule compression.

Implementation

The current robotic welding system used to manufacture the DDG 1000 PVLS will be modified by the selected integrator to support large-scale trials, which will demonstrate the system's capability to support production operations at that location. If a production component is approved for use in the large-scale trials, then the large-scale trials will be considered the implementation point if the trials are successful. If a mockup structure is used in place of the large-scale trials, then implementation will occur on the first production unit after completion of the trials. Implementation is expected to take place at the DDG 1000 PVLS cell in the Aluminum Shop at BIW in the third quarter of FY17 in production for DDG 120.

PERIOD OF PERFORMANCE:
May 2015 to November 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500, PMS 400D,

TOTAL MANTECH INVESTMENT:
$1,300,000

Pursuing Lifting Strategy Improvements with the Optimized Lifting and Handling Project

PERIOD OF PERFORMANCE:
March 2016 to September 2017

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 400

TOTAL MANTECH INVESTMENT:
$801,000

S2652— Optimized Lifting and Handling

Objective

The lifting and handling processes, procedures, and equipment currently utilized are not integrated across the enterprise. As a result, costs have risen as ship complexity and process steps increase. This project will study the entire lifting and handling process across all organizations and platforms to understand key cost drivers that need to be addressed to reduce costs. The project will develop organizational and technical solutions that target the cost drivers and develop a lifting and handling handbook. This handbook will provide coordinated guidance and any relevant lessons learned to all involved organizations and will establish methods of lifting and handling units that are optimized for entire construction and erection processes. The handbook will provide methods and procedures that aim to reduce man-hours and material cost by optimizing the lifting and handling of material in the shipyard; e.g., reduction of the number of moves and maneuvers.

This is a two-phased project with the first phase focusing on defining the current process and inefficiencies, the investigation of alternative methods and equipment to address the major cost drivers of the lifting and handling process and the development of potential solutions. Phase 2 activities will consist of development and prototyping of Phase 1 opportunities deemed promising for implementation. The opportunities will be piloted where the lifting and handling metrics can be tracked and the impact on cost and schedule can be evaluated. Phase 2 will conclude with a final report and issuance of a lifting and handling handbook and document an optimized process, and will dictate its use and control.

Payoff

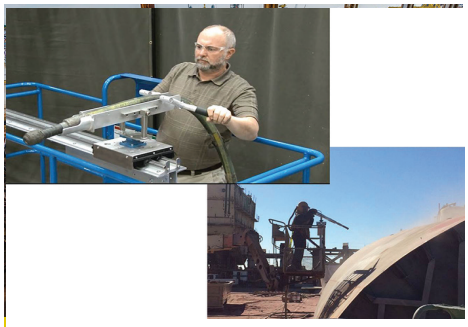
The implemented technology will reduce cost associated with lifting and handling which translate into a potential 5 year cost savings of $426K per DDG hull. More specifically the team expects the savings associated with this effort will have additional benefits for other Ingalls' platforms and have a 5 year savings across the Ingalls shipyard of $5.24M.

Implementation

Upon successful completion of the project, the 'Lifting and Handling Handbook' will be transitioned by Ingalls and process/procedures will be modified as informed by the handbook across all platforms and organizations. Ingalls Operations will follow the handbook and train personnel as needed. Ingalls Engineering is responsible for handbook implementation, maintenance and configuration management through approved company Quality Management System procedures. Ingalls' Quality Management System Process Owners will initiate and approve all changes to current process documentation, and will subsequently supervise any new training necessary for the process users. The expected implementation into a production environment is FY18 on DDG 122.

Implementation of Mechanical Arm for a Man Lift Application to Save Labor and Improve Ergonomics

R2658 — Abrasive Blasting Arm for Man Lift



Objective

Shipbuilders routinely perform abrasive blasting from a man lift to remove rust, mill scale, and other surface contaminants from the hull exterior. Workers manually manipulate the air hose and nozzle to blast the surface clean with compressed air and an abrasive media. Because of the physically demanding and repetitive operation, workers are required to take frequent breaks, increasing the overall labor to perform the operation. A Navy Metalworking Center (NMC)-led Integrated Project Team (IPT) developed an easy-to-use, motion-assisted positioning system consisting of a track-mounted mechanical arm attached to the aerial platform floor structure to reduce the effort required to abrasive blast the hull surfaces.

Payoff

The project-developed solutions are expected to save a total $840K over five years for all platforms constructed at Ingalls (DDG 51, LHA, LPD, NSC), increase productivity by approximately 25 percent by allowing the craftsmen to work longer, and create ergonomic benefits as a result of the reduced effort and exposure time.

Implementation

The technology developed under this project can be transferred to other Navy construction programs, shipyards, and industries that perform abrasive blasting from a man lift. In addition to the drawing package, NMC identified potential sources to manufacture the system and created a brief video that demonstrates the arm in an in-house mock-up. Huntington Ingalls Industries began using the blasting arm in March 2016.

PERIOD OF PERFORMANCE:
June 2015 to March 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 400D
NAVSEA

TOTAL MANTECH INVESTMENT:
$200,000

Enhancement to Automated Real-Estate Allocation System with Mobile Yard Inspector Tool

PERIOD OF PERFORMANCE:
January 2016 to May 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 400
PMS 500

TOTAL MANTECH INVESTMENT:
$436,000

M2675 — Mobile Yard Inspector

Objective

The Huntington Ingalls Industries – Ingalls Shipbuilding (HII-IS) Capacity Planning group's Automated Real-Estate Allocation System (AREAS) provides automated footprint and position planning for structural assemblies, and optimizes the utilization of construction space over time. Ingalls uses AREAS to create plans for moving assemblies as well as tracking and managing changes to the plans daily. In order to determine the impact to their plans, analysts must walk the shipyard, hand-writing notes and other pertinent information for manual entry into AREAS once they are able to return to their computer. This limits the ability to provide a timely accurate assessment of the current/planned assembly locations in the shipyard. These surveys provide needed insight into unexpected events and conditions an analyst would not gain except through visual inspection of lay down areas.

While AREAS provided significant assistance automating and optimizing capacity plans, the inability to work remotely limited the tools ability to be used at full potential. In order to optimize AREAS, capacity planners needed to be more agile to accommodate the multitude of rapidly changing conditions inside the yard daily. The 'Mobile Yard Inspector' tool (MYI) created the capability to perform real-time surveys of yard conditions and operational activities by enabling analysts to update AREAS remotely using a mobile device. The surveyors were able to document deviations from the plan and provide real-time data/notifications to analysts. The ability to provide most or all of the required yard condition information to AREAS remotely enabled very quick and efficient means of reacting to constantly changing conditions.

This was a Mega Rapid Response effort that leveraged Ingalls' steps to provide wireless capability throughout the majority of the yard. This presented opportunities for web-based applications to be accessed at the work site. The combination of these wireless capabilities and the MYI tool enabled Capacity Planners to react with agility on the job site, updating and re-planning in real-time with the best information possible, instead of being in transit to or behind a stationary computer inside.

Payoff

The MYI capability can support an annual reduction in hours required to produce capacity plans and manage the constant changes that affect the plan on a daily or weekly basis. This provided an additional cost savings of over $150K per year above the $990K per year achieved from the recently implemented 'Capacity Planning Automation' tool.

Implementation

Ingalls Shipbuilding deployed the solution in its target environment after initial acceptance tests were complete, and the affected individuals/groups/organizations were engaged to ensure the solution satisfied documented needs and expectations. The full implementation into a production environment was the third quarter of FY16 on DDG 119.

Mechanized Unit Construction Process to Provide Annual Savings at Ingalls

S2690 - Unit Family Construction Optimization

Objective

The Navy Metalworking Center is leading a Navy ManTech Integrated Project Team (IPT) that will improve unit assembly, pre-outfitting, and kitting of components within the Ingalls Shipbuilding (Ingalls) unit construction areas. In the Covered Slab Area at Ingalls, units are constructed from panels and bulkheads that are fabricated upstream in process areas such as the Panel Line and Shell Shop. Fit-up and assembly of these units are performed manually and require a significant amount of labor and transportation time. The IPT is focusing on improvements to the leveling of structures, handling/setting bulkhead structures, and transporting the structures among stations. In addition, upstream and downstream process areas, such as the Outfitting Hall and outdoor unit construction, will be evaluated and could benefit from the solutions developed by this project. The down-selected concept(s) will be demonstrated at Ingalls on unit assemblies to support full-scale implementation. Additionally, solutions developed as a result of this project will supplement Ingalls' shipyard modernization plans.

Payoff

Implementation of manufacturing technology solutions to construct unit assemblies is estimated to produce an annual savings of $1.4M across all platforms currently constructed at Ingalls (DDG, LHA, LPD, and NSC) as well as future platforms. The total projected five-year process savings for all hulls is $7.2M.

Implementation

Pilot testing will enable the IPT to validate the expected process savings, which will be used by Ingalls to support capital expenditure requests for full-scale implementation. Implementation will occur on the first available hull at Ingalls starting in January 2018.

PERIOD OF PERFORMANCE:
January 2016 to December 2017

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$1,327,000

LCS Projects

Technology Improvements to Lower the Cost of the 11-Round Guide Housing by at Least $800K

PERIOD OF PERFORMANCE:
July 2012 to March 2017

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$5,076,000

S2455 — Light-Weight Low-Cost SeaRam 11-Round Guide

Objective

The objective of this Composites Manufacturing Technology Center (CMTC) project is to develop an updated 11-Round Guide design incorporating current state-of-the-art composite materials technology in order to achieve a more cost-effective and lighter weight SeaRAM 11-Round Guide. An acquisition cost savings target of 50 percent has been established by PEO-IWS Close in Weapons System (CIWS) Program Office. Appropriate consideration will be given throughout the project to ensure that the lessons learned on the 11-Round Guide housing will be directly applicable to the 21-Round Guide. Phase 1 gathered the existing requirements and Technical Data Package, conducted a manufacturing trade study and evolved and down selected to one conceptual design for the 11-Round Guide housing that is lower in cost and lighter in weight. Phase 1 culminated in a Preliminary Design Review that also served as the gate for Phase 2. Phase 2 consists of Manufacturing Risk Reduction Testing, Final Design and Tooling Design. Phase 2 will complete upon successfully passing a Critical Design Review. Finally, Phase 3 will consist of building 3 SeaRAM 11-Round Guides and using those guides to execute the qualification test plan.

Payoff

Based on cost estimates to date, this project will lower the unit cost of the 11-Round Guide housing by at least $800K and as much as $1,200K while reducing the weight by 10-25 percent. Additional benefits to be realized include: (1) a parts count reduction, (2) lower maintenance cost through a reduction in aluminum parts and (3) an improvement to the permeability characteristics of the guide. Improvements to the 11-Round Guide will be applicable to the 21-Round Guide as well.

Implementation

This project is anticipated to occur over three phases. Phase 2 commenced upon successful completion of the Preliminary Design Review in Phase 1. Phase 2 includes the Risk Reduction Testing, Final Design, Tooling Design, Tooling Fabrication and the Critical Design Review. Phase 3 includes the fabrication of three complete guides, all qualification testing and will culminate in a Production Readiness Review. Phase 3 of this project is expected to complete in time for a 2017 implementation.

Scalable Electronic Warfare (EW) System Meets Cost Reduction Goals

S2558 — Manufacturing Cost Reduction for LCS Scalable Electronic Warfare (EW) System Phase 1

Objective

There is an urgent need for enhanced Electronic Warfare (EW) capability for Littoral Combat Ship (LCS). Under the concept of commonality, leveraging the Surface Electronics Warfare Improvement Program AN/SLQ-32(V)6 will result in a cost-saving scaled EW system solution SLQ-32 C (V)6. The proposed EW system will be designed to fit on both LCS variants. The focus is to reduce acquisition cost without proportionally reducing performance and exceed performance of existing SLQ-32 EW systems through a competition-based search to incorporate industry best-of-best in manufacturing and production of system subassemblies / hardware resulting in reduced cost. This project will produce the following: (1) a complete advanced technical data package (TDP) to support a full rate production competition, (2) a reduced AN/SLQ-32(V)6 model for proof-of-concept, customer evaluation, and a level-of-requirement and technical measure checkout, and (3) manufacturing technology integration of identified subassemblies for cost reduction including technologies for the millimeter wave downconverter, tuner technology, new filter substrates, integrated RF component design, automated test processes, common chassis and a replacement common processor system.

Payoff

SLQ-32 C (V)6 will provide an EW system that meets LCS mission requirements and performance objectives, as well as improving the capability offered by current systems. AN/SLQ-32(V)6 will also benefit, as the identified cost savings in manufacturing will be directly applicable through the common architecture. The insertion of advanced technology will result in a collateral benefit of cost reduction across all of AN/SLQ-32 variants, which is planned for over 150 ships (including DDG 51 and CVN 78) for future savings in acquisition and life-cycle cost savings. In addition, the U.S. Coast Guard will benefit from this effort because they have chosen to implement a SLQ-32 C (V)6 on the Offshore Patrol Cutters. The overarching payoff is that, while maintaining performance objectives set forth in the requirements document resulting from the Scalable EW Architecture for LCS ManTech project, the cost will be reduced by an estimated $1.1M per system.

Implementation

PEO IWS 2.0 will establish the schedule to implement the results of the Scalable EW System Cost Reduction project for SLQ-32 (V)6 and SLQ-32 C (V)6 through the Program of Record acquisition change process. The SLQ-32 C (V)6 production representative system completed assembly and formal qualification testing in 2014, and provided for customer evaluation on LCS 1 in FY14. It successfully completed at-sea testing in 2014 and 2015. The SLQ-32 C (V)6 Low Rate Initial Production (LRIP) will contain the TDP updates with the approved ManTech affordability improvements. For the overall SEWIP Block 2 Program, a quantity of 38 LRIPs has already been contracted to Lockheed Martin MST. Two of the ManTech affordability improvements have been approved for incorporation into the AN/SLQ-32(V)6 TDP baseline and have provided significant cost savings. All additional ManTech affordability improvements are scheduled for incorporation into the TDP baseline over the course of future AN/SLQ-32(V)6 LRIP and FRP procurements.

PERIOD OF PERFORMANCE:
March 2014 to June 2017

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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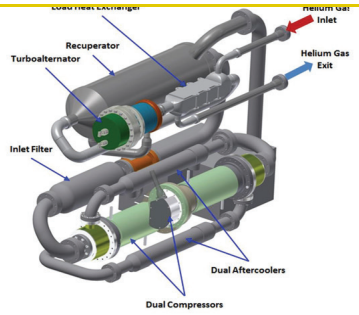
STAKEHOLDER:
PMS 501, PMS 378, PMS 500

TOTAL MANTECH INVESTMENT:
$7,710,000

Cryocooler Manufacturing Improvements Will Expand Use of HTS Degaussing Systems on Navy Ships



PERIOD OF PERFORMANCE:
July 2014 to April 2016

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$563,000

S2603 — Reverse-Brayton Cryocooler Manufacturing Improvements

Objective

High-Temperature Superconducting (HTS) degaussing systems require a cryogenic refrigeration system to maintain the low operating temperature of the HTS cables. Previously, Creare LLC has produced reverse-Brayton cryocooler units for one-off applications that have been driven by performance requirements and not by production costs. Improving manufacturability and reducing the production cost of these units will provide significant cost avoidance for the Navy and make HTS degaussing systems even more attractive for both near-term and future implementation on surface combatants. Based on the design for manufacturability assessment completed during this Navy Metalworking Center (NMC)-led effort, the production cost of the cryocooler can theoretically be reduced from $589K to $244K per cryocooler. The objective of this project was to achieve a cryocooler purchase price of no more than $200K per unit based on a 16-unit purchase.

Payoff

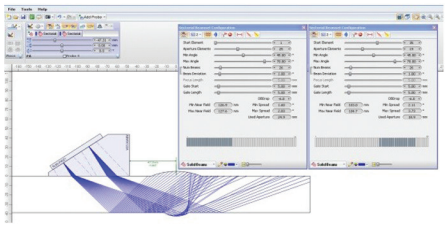
Substantial savings were identified in this project by switching to an alternative design for the recuperative heat exchanger, resulting in a final theoretical production cost of $162K per cryocooler. As mentioned above, the goal was to achieve a cryocooler purchase price of no more than $200K per unit based on a 16-unit purchase; success would have resulted in a $7M savings over five years if implemented on future ship classes.

Implementation

Due to a No-go decision by PMS 501, Office of Naval Research and NMC, the project was exited prior to demonstration/validation of the recommended manufacturing savings opportunities. While there was technical merit in completing this work, the group concluded it would not be a good ManTech investment to proceed with project tasking due to: 1) lack of progress in identifying and securing the required funding for transition and implementation, and 2) no foreseeable near-term opportunities to implement HTS degaussing or HTS power applications for the Navy. Because of the No-go decision, no implementation is anticipated.

VCS/OR Submarines Projects

Advanced Ultrasonic Inspection to Reduce VCS Construction Costs



PERIOD OF PERFORMANCE:
April 2013 to June 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,022,000

S2499 — Advanced UT Methods of NDT of Hull Welds

Objective

Historically, Radiographic Testing (RT) was used to inspect hull butt welds. Operations personnel involved with the ultrasonic inspection of hull welds have identified the practice of requiring certain hull butt weld configurations to be ground flush prior to Ultrasonic Testing (UT)) as a negative contributor to construction costs. The goal of this project was to reduce inspection costs for hull butt welds by implementing, where practical, the use of Phased Array Ultrasonic Technology (PAUT)/Time of Flight Diffraction Technique (TOFD) in lieu of RT and conventional UT. The project was executed in two phases. During the first phase, the project team determined the technical feasibility of inspecting hull butt welds with PAUT/TOFD technology. The second phase compared the effectiveness of conventional UT versus PAUT inspections on as-welded VIRGINIA Class submarine (VCS) hull butt welds at General Dynamics Electric Boat (GDEB) Quonset Point. The focus of this project was to determine feasibility of PAUT/TOFD as a replacement for conventional UT in order to reduce VCS inspection costs by upwards of 20 percent.

Payoff

The capabilities of the PAUT/ToFD system and continued research into the NDT and preparation for NDT as it relates to hull welds resulted in GDEB projecting a plausible savings of $318K per VCS hull driven by factors of reduced delivery time, reduced grinding time and reduced inspection times. GDEB also applied the logic to the concept of application on the OHIO Replacement submarine (OR) hull and came to a plausible savings of $476K per OR hull. While the primary focus of this project was the VCS Program, it also offers opportunities to improve manufacturing processes for the OHIO Replacement Program. The same benefits described here may also accrue to other U.S. Naval ships.

Implementation

Immediate steps have been taken to lay the groundwork for implementation of Advanced Ultrasonic Inspection of Hull Butt Welds. GDEB will assign commitment numbers through the Program Office for all communications relating to procedure approvals to mitigate extensive delays. Capital funding will require approval by Manager of Quality, GDEB Quonset Point and may be subject to departmental budget. Implementation will also be dependent on when SUPSHIP is qualified to oversee GDEB's inspection process.

Development of Fire Safe Resins for Submarine Applications

Q2533 — Composite Manufacturing Technology for Fire Safe Resins

Objective

Composite structures are often made of sandwich construction composed of a core and two face sheets. The traditional phenol processing approach results in laminates with excessive voids and reduced mechanical properties. Additionally, a robust FST-safe (fire, shock, and toxicity) core material for submarines does not exist and must be developed using materials that are already commercially available. The objective of this phased Navy ManTech Composites Manufacturing Technology Center (CMTC) effort in support of the VIRGINIA Class submarine (VCS) is to improve and demonstrate the manufacturability of an internal submarine article using the FST-safe resins. Some existing systems have been approved for use within the pressure hull of a submarine but the systems frequently have too many voids to be reliable. This project will identify improved manufacturing processes to reduce the phenolic void content and improve the design allowable. The second purpose of this effort is to identify novel commercially available materials and approaches to bring composite within the pressure hull affordably. Both the new processes and new materials will be screened using a cone calorimeter and then demonstrated on a doubly curved article. Mechanical properties will be generated to replace the outdated design information based on the legacy phenolic resin process.

Payoff

The result of this effort will be the processes, methodologies, and materials to be used to bring composites within the pressure hull. Those subsequent applications will allow for the removal of metal components in highly corrosive environments therefore reducing the life-cycle costs of the 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 DOD platforms.

Implementation

This project will transition to a follow-on project for point insertion. This follow-on effort will be S2679 Fire Safe Resins Phase 2 and is currently pending. Implementation will occur at General Dynamics Electric Boat (GDEB) with an anticipated date of 2019 on SSN 794. Initial work has been completed to develop implementation targets for the follow-on phase. A production vendor will be sought to demonstrate the techniques developed by the team in a production environment.

PERIOD OF PERFORMANCE:
November 2013 to December 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$664,000

Effective Submarine Baffle Tile Coating Will Save Life-Cycle Costs

PERIOD OF PERFORMANCE:
May 2013 to December 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Coatings

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$689,000

S2541 — GTC Durability Coating

Objective

The gradual transition coating (GTC) SONAR Baffle Tiles installed on Seawolf and VIRGINIA Class submarines (VCS) have experienced issues with cracking and delaminating while in service. During a recent VCS Extended Drydocking Selected Restricted Availability (EDSRA), several GTC tiles were cracked and required replacement. Applying a durability coating to the tile sides will eliminate these issues and ensure that the tile lasts throughout the life of the ship. The Navy Metalworking Center (NMC) led an Integrated Project Team (IPT) that extensively tested materials and process parameters to ensure that a coating of sufficient durability is implemented. The team also verified compatibility with the tile material and longevity in this environment. NMC researched and identified multiple candidate materials for use as a durability coating on the GTC, including both roller-applied and spray-applied materials. NMC subjected the selected materials to preliminary testing prior to down-selecting to the most promising candidates. Naval Surface Warfare Center, Carderock Division (NSWCCD) conducted mid-scale cyclic mechanical compression testing to further down-select the materials. Full testing included hydrolytic stability and large-scale cyclic compression. As a result of this testing, NMC delivered recommendations for durability coatings to improve the survivability of the GTC tile.

Payoff

Project results will be implemented on in-service Seawolf (SSN 22 and 23) and VCS (SSN 777 through SSN 781) with an expected life-cycle cost savings of $6.7M. Results also will be implemented on VCS during new construction for an estimated life-cycle savings of $5M (10 hulls over the next five years).

Implementation

Once PMS 392 and PMS 450 accept the project recommendations, implementation will occur in two ways. For in-service hulls, the shipyard personnel will apply the recommended coating if the tiles are scheduled for removal during an EDSRA, which will initially occur at Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility. For new construction, the durability coatings can be applied at the tile manufacturer or a third-party applicator after the procurement specification is changed.

The first application on in-service hulls is expected to occur on SSN 777. The first implementation of the durability coating for new construction is expected by the end of 2017. The construction shipyard will receive the tile with coating in place, creating no impact on construction activities.

Electric Boat is Incorporating 3D CAD Modeling Processes for Submarine Cable Installation

S2547— Improved Cable Lay and Sequencing for VIRGINIA Class and Ohio Replacement Submarine Programs

Objective

The VIRGINIA Class (VCS) and OHIO Replacement (OR) submarine programs have identified opportunities for significant and recurring savings generated from cable installation process improvements. The complex and exacting processes of designing, planning, and installing each one of the 15,000 to 20,000 cables on a nuclear submarine is challenging and laborious, a prime target for efficiency improvements. For example, typical work orders focus on small compartment size areas while cables can span through multiple compartments or even the entire length of the ship. Due to the modular design of many of the ship's compartments, numerous cable installation work orders cannot be processed until each compartment is ready which results in the necessity to warehouse excessive amounts of cable waiting for prolonged periods until the ship construction can support cable installation.

The typical cable installation process proceeds in standard phases: logical design, component physical design, cableway design, cable routing, cable lay, and cable sequencing. This project is focused on optimizing the final two phases of the typical cable installation process by re-engineering current cable lay and sequencing methods. The re-engineered processes will assist planners in the selection of smaller work packages, resulting in savings in material ordering, warehousing of cable, associated footprint reductions in outfitting areas, and more timely installation of cables in modules and on board the ship.

Payoff

Once implemented the project, by utilizing its superior design and sequencing methods, is anticipated to allow for a 10 percent cost reduction of the legacy cable installation process. The combined improvements to material ordering, cable warehousing, clutter reduction, and installation scheduling contribute to a potential savings of $2.7M per OR hull and $274K per VCS hull.

Implementation

General Dynamics Electric Boat (GDEB) will create and deploy a cable lay and sequencing tool that will allow electrical designers to create 3D CAD models of designated cable lays for particular cables across their routes. This will include the verification that designated Electro-Magnetic Interference (EMI) rules have strictly followed. Secondly, the tool will provide the capability to sequence cable installation based on status of the ship. It typically begins in the early stage of design where functionally related equipment, systems, tanks, etc. are located to reduce the distributed system footage and maximize standardization potential. The new tool is expected to be implemented on the lead ship for VCS Block V (VIRGINIA Payload Module (VPM), SSN 802) and the lead ship for the OR construction program.

PERIOD OF PERFORMANCE:
December 2014 to April 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 450
PMS 397

TOTAL MANTECH INVESTMENT:
$640,000

Trade-Friendly Locating Dimensional Technologies Can Improve Productivity

PERIOD OF PERFORMANCE:
May 2014 to March 2016 (NSAM)
October 2013 to February 2016 (iMAST)

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NSAM and iMAST

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$450,000 (NSAM)
$240,000 (iMAST)

S2550-A-B —Trade Friendly Locating Dimensional Techniques

Objective

Metrology technologies have dramatically increased their functionality and purpose for modern manufacturing. General Dynamics Electric Boat (GDEB) has capitalized on this technology by acquiring and using modern metrology systems for various VIRGINIA Class submarine (VCS) alignments and inspections but the technologies of choice are currently limited to certified and highly trained tradesmen and engineers. GDEB VCS modular construction (hull sections and hull decks) requires the tradesman's ability to quickly and accurately obtain metrology coordinate placement data during manufacturing operations, not post-manufacturing inspection and alignments.

The goal was to determine the feasibility and cost-effectiveness of GDEB "trade personnel" friendly dimensional locating metrology technology for immediate incorporation into the VCS manufacturing processes. This ManTech project was divided into two distinct phases, executed similarly to other standard process improvement efforts. The project team focused on both the physical requirements as well as the information requirements to prepare a tradesman to perform their work. In Phase 1, a total of 15 different metrology systems were evaluated against the defined requirements. Of these 15 systems, two were identified as meeting the requirements. The final two systems demonstrated through execution of an Evaluation Test Plan that they were capable and viable for prototype testing. One system was prototyped in Phase 2. This system was the top pick for 'trade friendliness' and earned the highest score during the technology evaluations. Phase 2 focused on testing of the down-selected technology identified and qualified based upon the requirements obtained during the Phase 1 investigation. While the primary focus of this project was the VCS Program, it also offers opportunities to improve manufacturing processes for the OHIO Replacement Program.

Payoff

This technology, once implemented, could potentially save an estimated $1.73M per VCS hull and OR hull. These savings will result from replacing or enhancing common mechanical measurement tooling.

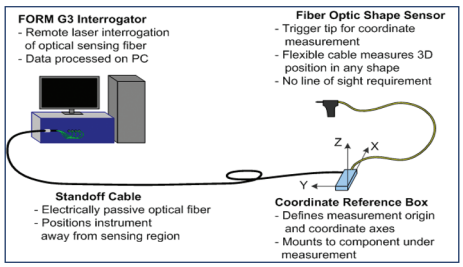
Implementation

Implementation of this technology is in process with the arrival of the first purchased system. Funding for additional systems is being pursued to support the VCS build rate and OR construction.

This project is a joint COE effort between Naval Shipbuilding and Advanced Manufacturing (NSAM) Center and Institute for Manufacturing and Sustainment Technologies (iMAST).

Novel Non-Line of Sight Dimensional Metrology for Shipbuilder Applications

S2559-2 — Fiber Optic Measurement and Shape Sensing Phase 2



Objective

Fiber Optic Measurement and Shape Sensing (FOMSS) technology provides accurate, real-time 3D position registration with a single free-moving cable attached to a single reference point. This flexible, non-line of sight cable is easy to deploy and use and is particularly effective in cramped / confined, close-range layout and verification applications. The system provides a user-friendly, adaptable, and ruggedized measurement tool to relieve man-hour investment in set-up, rework, and downtime associated with dimensional control applications. The FOMSS system demonstrated the ability to locate points in 3D space with an accuracy of 0.06" (RMS), facilitating implementation for shipbuilder applications requiring a 2 sigma accuracy of 1/8". The result is a robust, field-portable, highly accurate measurement system, which provides improved performance and substantial cost savings with applicability to a variety of Department of Defense (DOD) manufacturing processes and operational conditions.

Payoff

As it currently stands, the FOMSS beta unit, matured throughout this project, can be tied into ship's coordinates and determines point location in 3D-space in real-time with accuracy. The cost avoidance for VIRGINIA Class submarine (VCS) and CVN applications is estimated at $650K–$1.15M per VCS hull and approximately $400K per CVN hull. Huntington Ingalls Industries - Newport News Shipbuilding (HII-NNS) has determined that FOMSS repeatability must be 1/32" to be useful to their identified applications. Feedback from DMC 2015 and ShipTech 2016 suggests there are shipbuilder applications which could benefit from this tool with its current performance. Penn State EOC, in conjunction with Luna, is investigating additional transition opportunities for the FOMSS system. Defense manufacturing scenarios suitable for the FOMSS' system performance shall be explored and developed. This includes FOMSS improvements for demonstration purposes as well as site visits to determine if the FOMSS system can benefit existing DoD production scenarios.

Implementation

This project refurbished, upgraded, ruggedized, and optimized the prototype FOMSS system developed under a previous ManTech project, with shipyard piloting to occur at HII-NNS for characterization system utility in (VCS) and CVN aircraft carrier manufacturing applications. The FOMSS accuracy and repeatability values were verified by HII-NNS through numerous "in-field" applications – representative manufacturing scenarios. The repeatability of the FOMSS beta unit is equivalent to its accuracy. Repeatability was determined by HII-NNS to be an issue with better performance needed for practical shipbuilder utility for identified applications, and was therefore not implemented during this phase of the project. With the current accuracy and repeatability of the system, NNS suggested the system could be used on applications with tolerances around 1.000" or greater. One potential application that fits this criteria is the scenario involving Stud Gun integration for both CVN and VCS. HII-NNS stated there remain very interested in the technology and would implement this system provided it can meet the identified requirements and they would develop an implementation plan at that time. Luna has developed a white paper that addresses additional system improvements.

PERIOD OF PERFORMANCE:
May 2014 to November 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 450, PMS 378

TOTAL MANTECH INVESTMENT:
$575,000

Special Hull Treatment Improvements Achieve Early Implementation on VCS

PERIOD OF PERFORMANCE:
March 2014 to November 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Coatings

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,225,000

S2562 — Improved Tiling Systems

Objective

Improving the design, manufacturing and application of Special Hull Treatment (SHT) on VIRGINIA Class submarines (VCS) can reduce installation and maintenance costs. SHT is installed via a bond-in-place (tile) or mold-in-place process, depending upon the location on the hull. The Navy Metalworking Center led this ManTech project to evaluate several improvement areas to reduce cost and enhance performance. General Dynamics Electric Boat Corporation (GDEB) reviewed the bond-in-place installation process and materials and identified the following areas for further investigation: improve tile manufacturing processes to reduce cost and rework, modify tile features to aid in installation, improve installation materials and processes to reduce installation time and increase reliability, and enhance manufacturing process for multi-layer tile. The project team established requirements, identified candidate processes and materials, performed multi-staged technical evaluations, and generated a cost-savings analysis to verify that the project metrics were being met.

Payoff

Improvements to materials and/or installation processes will lower the cost to manufacture the tile, decrease installation labor and rework, lower overall installation time, and improve reliability. These savings include $440K per hull to cast tile to near-net thickness and an additional $125K per hull to create additional stock tile sizes. If PMS 450 successfully completes the alternative seam filler configuration, then an estimated $135K per hull can be avoided at Post Shakedown Availability and $450K can be avoided at each of the four Extended Dry-docking Selected Restricted Availabilities, due to the increased durability of the SHT system. Results of this project will also benefit the Ohio Replacement Program (PMS 397), which will save an estimated $848K per hull by casting tile to near-net thickness and creating additional stock sizes.

Implementation

Among the project results, GDEB provided recommendations to minimize material waste by casting to near-net thickness and by increasing the number of stock tile sizes used to machine the final tile shapes.

GDEB partially implemented near-net-thickness molding on VCS tiles in the fourth quarter of FY15, and fully implemented the results in early FY16 to realize a total savings of $440K per hull. In addition, the VCS Program Office (PMS 450) has accepted the project-developed assembly process for multi-layer tile, which will be used to procure the tile for the large-scale mock-up and ship test patch.

Developing CAD/CAM Interface for Steel Processing Efficiency improvements

S2591— CAD/CAM Interface for Steel Shape Processing

Objective

General Dynamics Electric Boat (GDEB) has made significant investments in new manufacturing technologies and processes in order to support the schedule demands for VIRGINIA Class (VCS) and OHIO Replacement submarines. One such improvement is the automated processing of steel shapes, including cutting, footprint marking, and coping. This technology has matured among construction industries and has proved well suited to ship construction. Shape processing machines such as the Voortman® utilize a standardized format (DSTV) for model input. The first generation usage of the Voortman® at GDEB will require manual input of program instructions. The objective of this project was to develop the interface to feed the shape-processing machine directly from the Computer Aided Design (CAD) product model without manual intervention. The proposed tool will be adaptable as it uses standards base format; it will save time and money because it automates a currently manual process and will provide fewer errors. It will also advance the state of manufacturing technologies for shipbuilders because it automates CAD to Computer Aided Manufacturing (CAM) interface for structural steel shapes. The basic technology exists though requires adaptation to support shipbuilding requirements.

The project included one set of tasks covering a 17-month period of performance. The first task defined the detailed design requirements, the subsequent five tasks developed and tested various capabilities of the software. A demonstration of the tool capabilities was conducted for all GDEB Stakeholders.

Payoff

This technology, once implemented, could potentially save an estimated $518K per OR hull. These savings will result from increased efficiency in installation due to markings necessary to support component fabrication.

Implementation

GDEB is executing the implementation of the CAD/CAM Interface Tool. The GDEB Production team has the goal of making the tool available for use to all end-users by the end of FY 2016. Training and work procedures are being made available as a part of the implementation task.

PERIOD OF PERFORMANCE:
December 2014 to May 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 450
PMS 397

TOTAL MANTECH INVESTMENT:
$424,000

Providing Accurate Information Regarding the Use and Availability of Critical Resources for Planning

PERIOD OF PERFORMANCE:
September 2015 to March 2017 (NSAM)
October 2015 to March 2017 (iMAST)

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM and iMAST

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$526,000 (NSAM)
$450,000 (iMAST)

S2593--A-B — Critical Resource Planning

Objective

A tool is needed to monitor and forecast the use of critical construction resources (e.g. support/transportation equipment) at General Dynamics Electric Boat (GDEB). The focus of this project is a software-based tool that is capable of providing accurate information to Planning regarding the use and availability of critical resources at GDEB and its partners. The tool will be capable of providing statistical data to Planning regarding the downstream effects of schedule changes, added work, or changes in a manufacturing assembly plan. The data generated within the tool can then be used to estimate the total cost of a planned/unplanned change event or evaluate the total cost of a proposed plan. The tool will track information beyond the capabilities of current spatial and capacity planning tools and ensure that sufficient quantities of each critical resource exist at all phases of construction.

The project will be executed in two phases. The first phase investigated and included a thorough requirements gathering from potential end users and GDEB management, development of recommendations and the design of a prototype critical resource planning tool graphical user interface, and the inventory and prioritization of all Electric Boat critical resources. Phase 2 will include the development or extension of the data table to feed the critical resource planning tool, the development of a prototype graphical user interface that processes planning data and incorporates requirements as defined in Phase 1, and the development of specific use cases to be tested with initial deployments of the critical resource planning software. A thorough testing procedure will be developed and executed. After verifying full functionality of the critical resource planning software, the project team will demonstrate the tool to GDEB stakeholders as well as project sponsors.

Payoff

This technology could potentially save an estimated $352K per Virginia Class Submarine (VCS) hull and $2.17M OHIO Replacement (OR)hull.

Implementation

Implementation is expected to utilize a phased approach, where the most beneficial opportunities will be assigned higher priority and implemented first. The results of this ManTech project may be implemented in production of VCS hulls as early as FY17. However, the schedule for implementation activities is dependent on project results.

This project is a joint COE effort between Naval Shipbuilding and Advanced Manufacturing (NSAM) Center and Institute for Manufacturing and Sustainment Technologies (iMAST).

Development of Enabling Composites Technology for Submarine Applications

Q2596— Enabling Technologies for Integrated Manufacturing of Submarine Components

Objective

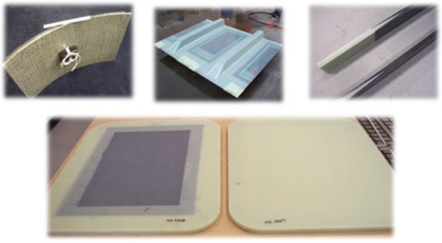
Like other programs in the Department of Defense (DOD), the VIRGINIA Class submarine (VCS) program and the OHIO Replacement (OR) Class submarine program face substantial financial challenges due to the current fiscal environment. OR is additionally challenged because of considerable procurement cost for the lead ship and target costs for ships 2-12 of the class. Reaching the target procurement costs for the OR platform are only attainable through cost-effective designs that save money over the entire life of the submarine and manufacturing approaches that reduce acquisition costs. The objective of this project was to develop and validate repeatable manufacturing approaches, and their associated cost and weight impacts, for submarine applications. This project used a systems-engineering approach to determine groups of components with similar requirements that can then be mapped to enabling technologies and/or combination of technologies. Enabling technology and manufacturing approaches to be considered under this effort included: out-of-autoclave (OOA) processing to enable efficient use of carbon fiber; multi-material (glass/carbon hybrid) solutions for cost / weight reduction; integrated manufacturing of structural-acoustic windows; integrated manufacturing of laminates with structural damping treatments; and integrated manufacturing of laminates with polymer coatings.

Payoff

Significant cost and weight has been removed from both platforms by replacing conventional metallic and/or traditional GRP components with state-of-the-art composite structure. While innovative composite materials and the integrated manufacturing opportunities that they afford offer cost / weight reduction opportunity, a platform-wide analysis of the systems / components that can benefit from these technologies is required in order to define the technology / combination of technologies that result in the largest payoff. Understanding the technical and cost relationships between innovative composites and the spectrum of components that they can improve provides alternative design and manufacturing approaches for groups / families of components currently manufactured using GRP or steel on a broader level. This approach affords a comprehensive impact to cost / weight reduction initiatives compared to historical single component analysis. The deliverables developed because of this effort provide a valuable data attribute to be used by both the government and General Dynamics Electric Boat (GDEB) for performing design trades and component pricing estimates.

Implementation

The techniques and processes developed in this project were leveraged to composites currently on the submarine and to future efforts. This project demonstrated a production ready composite article that could transition at the end of this Manufacturing Science and Technology effort. Implementation is planned to occur with SSN 792 first.



PERIOD OF PERFORMANCE:
December 2014 to June 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,176,000

VIRGINIA Class Payload Module Low-Cost Hybrid Fairings

PERIOD OF PERFORMANCE:
April 2015 to April 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$2,188,000

S2601— Low-Cost Hybrid Fairings

Objective

The objective of this effort is to further refine and develop gateway technologies, techniques, and processes and demonstrate that cost-effective design and manufacturing solutions are achievable with acceptable risk for faired structures fabricated from composite and/or hybrid material systems. This task addresses high priority defense and Navy needs, attacks pervasive manufacturing issues, and addresses manufacturing technology beyond the normal risk of industry. Several innovative technologies used either individually or in conjunction with one another, are under consideration for use in VIRGINIA Payload Module (VPN) configurations. Each would employ the use of enhanced composite materials with integrated stiffness and damping, or a combination thereof, to form the fairings that make up the boundary of the VPM. Active Office of Naval Research development efforts are being leveraged in support of this ManTech project.

Payoff

Successful incorporation of the above technologies into the VPM design has the potential to provide significant acquisition and life-cycle savings to the VIRGINIA Class submarine (VCS) platform for Block V and following ships. Acquisitions savings have been estimated to be between $4 and $12M and life-cycle savings for all of the options included have been identified to be between $18.9M and $20.7M, depending on the options selected during the initial down-select. These values include the incorporation of composite fairings in conjunction with the hybrid fore / aft fairings. They also assume incorporation of these concepts in each of the 20 hulls remaining in the VIRGINIA Class starting with the SSN 802.

Implementation

The component down-selection phase of this project is expected to be complete in 2016 to support VPM arrangement design schedules. Technology development was pursued during the initial six months of this effort and will entail four tasks that address requirements definition, material, and construction options, attachments and interfaces, and inspection and repair solutions. The fabrication of full-scale prototype(s) will be completed by fall of 2016. Over the subsequent months, technology demonstration will consist of two tasks that will identify critical aspects of the proposed solutions from Segment I as well as the development and manufacture of full-scale prototype(s). After successful completion of the project, technology will be incorporated into the design of the VCS VPM. It is expected that it will also facilitate consideration for similar technology insertion into OR Class components and structures of comparable design/function. Implementation targets are SSN 802 and VCS Block V.

User-Friendly Weld Sequencing Tool to Save Labor Costs and Improve Schedule for Navy Submarines

S2602— Weld Sequence Planning for Major Assemblies

Objective

Weld-induced distortion on major ship assemblies creates a significant manufacturing challenge and affects both cost and schedule. This Navy Metalworking Center project is developing a user-friendly weld sequence-planning tool that allows the shipbuilder to quickly determine the optimal weld sequence and best practices to improve acquisition affordability for Virginia class submarine (VCS) and Ohio Replacement (OR) platforms. Currently, weld-induced distortion on major VCS assemblies, such as foundation tanks, bulkheads, and box girders, is addressed by trial and error and the application of trade experience during the fabrication process. This methodology results in substantial labor hours, rework, and a lack of repeatability hull to hull. Software packages are available to simulate welding processes; however, even an experienced analyst can take weeks or months to arrange, run, and obtain results from detailed weld analysis. This project will enhance commercially available software so that it can quickly and easily be used by manufacturing planners to provide best practice fixture and weld sequence recommendations to the shop floor to minimize distortion and obtain critical structure tolerances with reduced rework.

Payoff

General Dynamics Electric Boat (GDEB) estimates a $3.87M cost savings over five years for VCS and $580K per OR hull through reduced trial-and-error weld sequencing, mitigation of weld-induced distortion in the final product, and improved throughput. This solution also has the potential to impact all platforms that experience weld distortion (CVN, LHA, DDG, LPD, etc.), which could result in significant long-term cost savings.

Implementation

The Integrated Project Team (IPT) evaluated multiple commercialization partners to develop an enhanced weld sequence-planning tool. The IPT selected ESI Group as the weld sequence planning tool developer based on development proposals and sample results. The final tool will be validated on a common major VCS/OR assembly at GDEB. The tool is expected to be implemented at GDEB on SSN 796 starting in the second quarter of FY17.

PERIOD OF PERFORMANCE:
July 2014 to February 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450
PMS 397

TOTAL MANTECH INVESTMENT:
$1,765,000

New Manufacturing Process to Simplify Design and Construction of Complex Submarine Deck Structures

PERIOD OF PERFORMANCE:
June 2015 to December 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 397, PMS 450

TOTAL MANTECH INVESTMENT:
$1,498,000

S2633— Self-Locating/Self-Fixtured Structure

Objective

The Navy Metalworking Center led a Navy ManTech project that developed and optimized a more efficient way of fabricating submarine deck structures, which have been traditionally constructed of many short, fitted pieces (intercostals) between continuous beams. An Integrated Project Team (IPT) developed the manufacturing process for a new concept of fitting and joining the deck structures for Ohio Replacement (OR) submarines and the Virginia Payload Module (VPM). The new concept, the self-locating, self-fixtured (SLSF) method, will enable construction with notched beams that interlock and are continuous in both directions. The IPT investigated cutting, weld joint methods, fixturing, and temporary bracing requirements, both with finite element analysis and trial fabrications, to determine the most efficient means of building these structures. A final mockup construction at Electric Boat Corporation (EB) will integrate the tooling, fixturing, weld sequencing, welding, handling, and post-construction straightening methods to be implemented by EB for construction of OR and VPM deck structures.

Payoff

Numerous benefits can be derived by implementation of the SLSF construction method, including reduced part count, simplified fit-up and inspection, a lowered skill set required for fit-up, and less labor and duration required for setup and fabrication. Elimination of overall part shrinkage also will facilitate direct part layout on deck plating prior to deck construction, which will benefit all trades in construction of the ship. The estimated savings are $3.02M on the first two OR hulls and $760K on each of the eight VPM sections planned for Block V in the first five years following completion of the project, for a total five-year benefit of $12.1M.

Implementation

While the construction method is relevant for many platforms, including surface ships, OR and VPM are of particular interest for this technology. Transition of the project results to OR should occur in FY17 before detailed design begins, thus avoiding significant design change costs. Implementation is expected on the lead OR hull and on the first VPM in FY19 at EB's facility in Quonset Point, RI.

Applying Work Cell Principles will Reduce the Cost to Manufacture Thousands of Hangers on Navy Submarines

S2634 – Automated Hanger Manufacturing

Objective

Shipboard systems use several thousand hangers to install and route pipe, ventilation, and electrical cable throughout the ship. The Navy Metalworking Center is conducting a Navy ManTech project that will streamline the production of hangers used extensively on naval submarines at General Dynamics Electric Boat (GDEB). An Integrated Project Team (IPT) is developing an automated work cell(s) to efficiently produce several types and sizes of hangers that are used to route pipe, ventilation, and electrical cable onboard Virginia class submarines (VCS) and Ohio Replacement (OR) submarines. GDEB manufactures these parts in several labor-intensive forming and machining operations that are dispersed throughout the facility.

Payoff

Implementation of mechanized or automated processes to manufacture shipboard hanger assemblies is anticipated to save an estimated $943K per VCS hull and $1.79M per OR hull. The savings estimate is derived from an anticipated cost reduction to manufacture 25,000 hangers per VCS hull and 47,500 hangers per OR hull. The savings will be realized through a reduction in rework and material handling as well as an increase in throughput, resulting in a potential five-year savings of $10.3M.

Implementation

The IPT is evaluating the commonality between part designs, the manufacturing processes used for fabrication, and the material movement between the processes. Using that information, the IPT will develop and demonstrate an optimized process using work cell principles. The project results will be implemented at GDEB on VCS and OR platforms, beginning fiscal year 2018.

PERIOD OF PERFORMANCE:
May 2015 to September 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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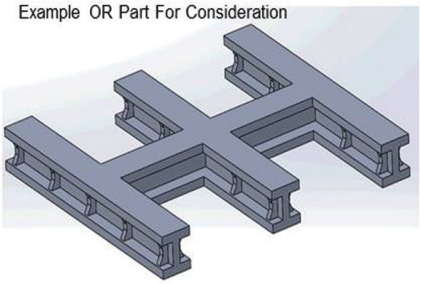
STAKEHOLDER:
PMS 450
PMS 397

TOTAL MANTECH INVESTMENT:
$1,670,000

Printed Sand Casting Molds and Cores for HY Steels to Save Costs for VCS and OR Programs



PERIOD OF PERFORMANCE:
June 2015 to November 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450
PMS 397

TOTAL MANTECH INVESTMENT:
$1,376,000

S2635 - Printed Sand Casting Molds and Cores for HY Steels

Objective

The Navy Metalworking Center is conducting a Navy ManTech project that is investigating the use of printed sand mold technology to produce complex high yield (HY) steel castings for the Ohio Replacement (OR) and Virginia class submarine (VCS) programs. These components are currently produced as steel weldments, which are challenging and expensive to manufacture. Printed sand mold technology offers the ability to rapidly design, produce molds and cast complex geometries that would be difficult, if not impossible, to achieve as weldments or conventional castings.

Payoff

Printed sand molds and cores provide design for manufacturing improvements while offering ordering flexibility for design trials. This project will reduce rework and material handling and increase throughput as a result of a more efficient work flow. The preliminary savings estimate of converting complex welded assemblies to castings is $1.1M per OR hull and $271K per VCS hull. The potential five-year savings for both platforms are $4.1M. This solution also is available to other weapon systems.

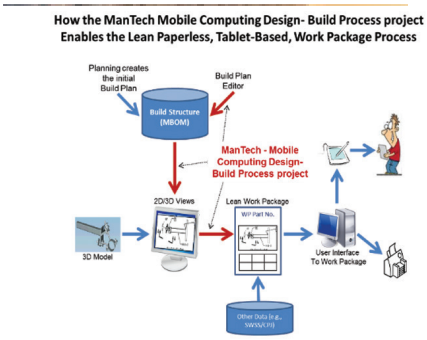
Implementation

An Integrated Product Team is baselining the mold printing process to characterize the variability in specific process parameters, such as sand grain size, binder additives such as black oxide, or the use of mold wash, in order to mitigate any quality or casting defects with the HY80 material.

Bradken Inc. is expected to use the developed procedure to fabricate HY steel castings from printed sand molds and cores, with implementation planned for the first OR hull and the first Virginia Payload Module at Electric Boat in January 2019.

Mobile Computing Design-Build Process' Will Create Lean Tablet-Based Work Packages

S2653 — Mobile Computing for Design Build



Objective

VIRGINIA Class Submarine (VCS) Program's legacy work instructions come with traditional engineering drawings that contain much more information than is needed for any particular task. One of the principal savings from this project will be the lean paperless work package with graphics geared only to the work at hand. Conversion of the legacy VCS design data will allow for the creation of Build Authority (BA) views and models. BA models will provide graphical views that represent build (as opposed to design) geometry.

This project will create a lean paperless work package built from the legacy VCS product model and create tools and processes to enhance Electric Boat's (EB) lean work package, structural fabrication, and outfitting system. These tools and processes would support shift level work instructions, delivered on a tablet in PDF form for the Electric Boat Quonset Point facility using legacy VCS data. The project will focus primarily on work instructions for structural fabrication; however, the expected outcomes will be applicable to other disciplines.

This is a two-phased project with Phase 1 defining the requirements for a lean paperless work package and the associated BA data and models needed. Phase 1 will also include the development of a Build Plan Editor. Phase 2 will be developmental and will include the integration with the NX delivery work instruction. This integration will be followed by the development of a prototype lean paperless work package. Phase 2 will conclude with a demonstration of this tool to all stakeholders.

Payoff

This implemented technology will provide a 2.5 percent improvement of 30 percent of the employees / trades personnel at their daily activities. These savings would be distributed across multiple functional areas such as operations, planning and through automated processes with an estimated cost savings of $910K per VCS hull.

Implementation

The result of this project is not a specific product or weapon system (or modification thereof) that requires high-level Navy or Program Officer approval for implementation. The first stage of general integration of the Build Plan Editor into the production environment will be management buy-in. It will be necessary to demonstrate the utility and cost saving features of the tool to upper-level management to obtain approval for the use of company assets in deploying the Build Plan Editor. Following that, coordination with company IT technicians will enable the transition from test software to select deployment across the company's computer network. The IT Department will handle distribution as well as data integration with other Electric Boat data sources such as Artemis Project Management and TeamCenter Product Lifecycle Management systems. The expected implementation into a production environment is FY18 on SSN798.

PERIOD OF PERFORMANCE:
March 2016 to March 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NSAM

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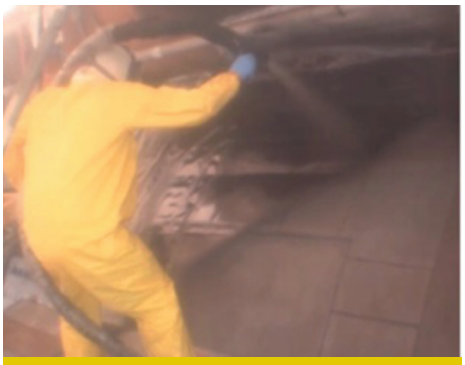
STAKEHOLDER:
PMS 450
PMS 397

TOTAL MANTECH INVESTMENT:
$977,000

Development of Automated Manufacturing of Hull Tiles Results in Better Tile Reliability



PERIOD OF PERFORMANCE:
February 2016 to January 2018

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Coatings & Automated Tools

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,200,000

S2655 -1 - Automated Manufacturing of Hull Tiles Phase 1

Objective

The objective of this effort is to develop an automated manufacturing technique for large and/or complexly configured tiles, thus reducing cycle time and improving manufacturing rate and response time to tile design and formulation changes. A second benefit is the insight to be gained from this technology and its potential use to apply the existing treatment directly to the hull, thus superseding the molding process. This project could lead to a follow-on task to improve SHT installation efficiency of the material currently molded on the hull. This effort would be applicable to new SHT configurations on Block V, back-fit on VIRGINIA Class submarines, and potentially applicable to OHIO Replacement (OR).

Payoff

The main benefit of Phase 1 is the ability to manufacture large and/or complexly configured tiles using existing treatment material formulations. This would permit the lateral development of spray application techniques to replace existing techniques and facilitate on-hull additive manufacturing and enable the exploration of additional formulations for future development. Completion of Phase 2 will lead directly to manufacturing of complex tiles.

The completion of both phases would amount to an estimated cost savings of $1M per ship. This assumes a shipset of approximately 550 large tiles intended to replace roughly 25% of existing hull treatment. Automation of the manufacturing process will reduce the size of the crew as well as eliminate the need for large scale ovens and precise metal molds. Specialty shapes could be programmed, which would result in minimal trimming of tiles, eliminate the need to cut specific shapes from slab stock, and reduce both labor and material waste. Automation will also reduce the cycle time per tile, which is heavily dependent upon assembly, disassembly, and reassembly of tooling. The automated process would not require tooling changes, and would depend solely on the rate at which material could be deposited and the tile built up. This could reduce the process from 4 days to as short as 24 hours.

In the event that only Phase 1 is completed, savings would not be associated with replacing an existing VCS trowel application with a spray application. Benefits include improved process control, less rework, improved reliability, and a greater degree of design flexibility. Potential cost savings for this application is estimated to be $100K per ship.

Implementation

The implementation of this effort will occur in two phases over 5 years and will be composed of two principal efforts, development of the material processing parameters and integrating those with an optimized automated methodology. This project will end with a direct transition to Phase 2 to develop a full scale manufacturing demonstrator.

Improved Pipe Cutting / Beveling Processes Onboard Navy Ships to Save Labor and Injuries

S2691 - Pipe Cutting Machine Technology

PERIOD OF PERFORMANCE:
January 2016 to July 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Outfitting

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450
PMS 398

TOTAL MANTECH INVESTMENT:
$885,000

Objective

The Navy Metalworking Center (NMC) is leading a Navy ManTech project with Newport News Shipbuilding (NNS) and Ingalls Shipbuilding (Ingalls) to develop an improved onboard pipe cutting/beveling process that will result in reduced labor requirements and safer working conditions. For large, thick-walled piping (3-inch diameter or greater, schedule 40 or 80); large, heavy portable equipment not suited for the confined working conditions onboard Navy vessels or handheld cutting/beveling tools are currently being used by both NNS and Ingalls. Both of these methods place a physical burden and/or ergonomic strain on the workforce that could result in worker injuries and down time. Additionally, these operations require non-value-added labor and/or inefficient operational conditions resulting in increased construction costs and outfitting schedule. The NMC-led Integrated Project Team will identify and develop improved equipment/tooling to facilitate efficient onboard pipe end preparations. Prototype tools and fixtures will be developed and evaluated in a simulated mock-up, and the most promising solutions will be optimized for demonstration and implementation in the shipyard. Additionally, a final design package will be created and business case analyses will be performed to support Ingalls' and NNS's capital expenditure requests.

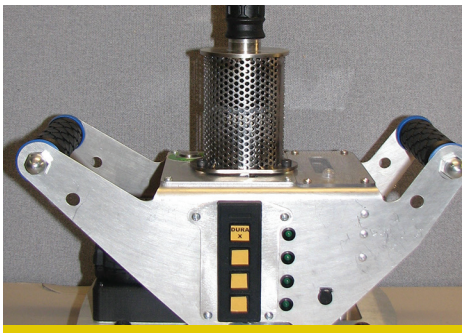
Payoff

The total projected five-year savings are $3.5M as a result of the reduced labor for all hulls affected at both shipyards.

Implementation

Upon completion of the project, any full-functioning prototypes will be transitioned to NNS and Ingalls to begin initial implementation. Additionally, using the final design package, associated vendor quotes, and shipyard capital funding, orders will be issued for multiple systems. Once obtained, these will be inserted into the work schedule on the first available ship classes. Implementation of the project results is expected on VCS and CVN new construction as well as CVN Refueling and Complex Overhaul at NNS, and DDG 51, LHA, LPD, and NSC new construction at Ingalls in the first quarter of GFY18.

Modified SHT Debond Detectors Delivered to Pearl Harbor Naval Shipyard for In-Service Use



PERIOD OF PERFORMANCE:
February 2016 to May 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing & Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$75,000

R2709 - Debond Detector Units

Objective

Special Hull Treatment (SHT) on VIRGINIA Class submarines (VCS) must be inspected for debonded areas during new construction and each docking availability. The manual tap inspection method is time-consuming and subjective. To minimize effort and to remove subjectivity, the Navy Metalworking Center (NMC) developed a debond detector under a previously funded Navy ManTech project (S2363) for use during new construction. In a subsequent project (R2607), NMC modified the debond detector design for use on "in-service" assets and delivered demonstration units to PMS 392, which demonstrated the units at Pearl Harbor Naval Shipyard (PHNSY) and Intermediate Maintenance Facility (IMF). PHNSY and IMF requested modifications to the unit due to its unique requirements. This project's objective was to incorporate PHNSY and IMF improvement requests to the unit and deliver three debond detectors to them. NMC updated the drawing package and procured or manufactured all of the necessary mechanical components. NMC assembled the units, tested them for proper operation and shipped them to PHNSY.

Payoff

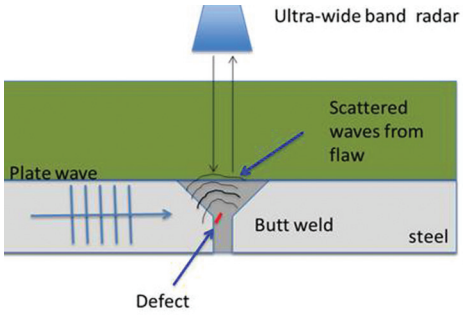
The modified debond detector will eliminate operator subjectivity during in-service VCS debond inspection, reduce the level of training required for inspectors, save an estimated 100 labor-days per hull, and reduce false positive inspection results.

Implementation

These units will be used to perform initial inspection to identify debonded areas of SHT. Three debond detectors were delivered directly to PHNSY and IMF for use on VCS hulls during future availabilities.

Improved Inspection Techniques for Submarine Pressure Hulls will Save Construction Costs

Q2711 - Inspection Under SHT Phase 1



Objective

The Navy Metalworking Center (NMC) is conducting a Navy ManTech project that will reduce the cost of the periodic inspection of submarine pressure hulls. The current processes, including visual and ultrasonic inspection, require the removal of significant amounts of special hull treatment (SHT) to access the hull structure underneath, followed by reinstallation of SHT after the inspection. SHT removal, inspection and reinstallation are on the critical path for the schedule of a submarine availability. Technologies that can inspect directly through SHT, or minimize the amount of SHT that needs to be removed, will significantly reduce the cost of hull inspection. Technologies of significant interest include the use of ultra-wide band radar, phased array ultrasonic with reduced contact area, and terahertz imaging. In Phase I of this project, NMC is evaluating the feasibility of these advanced inspection technologies for use in this application. Should one or more of these technologies prove to be feasible, their use could reduce the burden of SHT removal and reinstallation as well as the cost of the overall process.

Payoff

Reducing the amount of SHT that must be removed and reinstalled to accommodate hull integrity inspection during availability of the VIRGINIA Class submarine has the opportunity to reduce cost by as much as $1.2M per hull per inspection cycle, or $6M over a five-year period.

Implementation

Phase 2 of this project will develop a prototype system to demonstrate/validate the technology. Successful project results will be transitioned to NAVSEA 05U7 for implementation at the Navy shipyards, including Norfolk Naval Shipyard, Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility, Portsmouth Naval Shipyard, and Puget Sound Naval Shipyard & Intermediate Maintenance Facility.

PERIOD OF PERFORMANCE:
February 2016 to February 2017

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing & Fabrication

CENTER OF EXCELLENCE:
NMC

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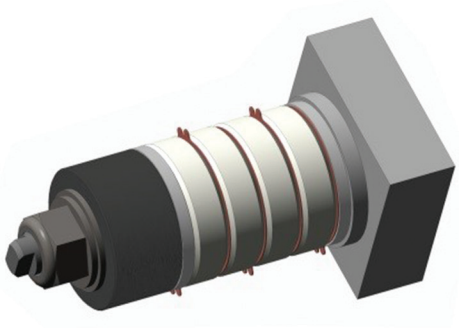
STAKEHOLDER:
PMS 450
NAVSEA, PMS 406

TOTAL MANTECH INVESTMENT:
$625,000

Acoustic Module Manufacturing Study to Lower Costs and Increase Producibility



PERIOD OF PERFORMANCE:
February 2015 to December 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Electronic Processing & Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMS 404

TOTAL INVESTMENT:
$100,000 (Non-ManTech)

M2717 — Acoustic Module Improvement

Objective

The current process for manufacturing acoustic modules requires significant touch labor for cleaning, inspection, and testing the incoming piezoelectric (PZT) rings. Assembling the ring stack requires precise alignment and application of adhesives and coatings. A time estimation of transducer assembly has shown that small changes in design and processing can enable a streamlining of steps and the subsequent reduction in costs. Through automation and optimized materials and manufacturing techniques, process improvements can increase reliability, efficiency, and reduce acquisition costs. The objective of the Acoustic Module Improvement Study was to identify assembly, test, and integration improvements to the acoustic module manufacturing process. With the potential of building more than 100,000 ultrasonic transducers in the next several years, small improvements in the materials and manufacturing processes can lead to major cost reductions. From surveying transducer manufacturers and process specifications, best practices were identified and the applicability of newer tools and techniques recommended for incorporation to meet the cost, technical, and schedule requirements of the acoustic module acquisition programs.

Payoff

It is anticipated that the automation, test, and integration improvements to the ultrasonic transducer manufacturing process will result in more than 20 percent cost savings per array leading to over $10M cost savings during the upcoming array procurements. The improved process that is scalable to larger and smaller stack type transducers enables usage on multiple platforms. Through automation, the inspection, cleaning, and preparation steps can be streamlined and the precise assembly of the piezoceramic ring stack accomplished.

Innovative redesign using additive manufacturing can produce a lighter, stiffer head mass with internal structures unachievable applying conventional machining processes. Through multiphysics analysis and design software and selective laser melting, the head mass displacement can be maximized and the contact area widened to acoustically match water. Data from the initial ring testing can also be used to predict the optimal mass of the printed head and tail sections to provide the desired resonant frequency, reducing or eliminating the need for final tuning.

Implementation

The project is scheduled to implement as part of the significant procurement contracts for Mod zero Array Kits and Mod one Array kits included in PMS 404's Undersea Weapons Modernization Program for the MK54.

Joint Strike Fighter Projects

Improved Boot System to Save F-35 Joint Strike Fighter over $180M

PERIOD OF PERFORMANCE:
April 2013 to August 2016

PLATFORM:
F-35 F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$1,989,000

A2513 — F-35 Automated and Rapid Boot Installation Phase 1

Objective

Complex shaped and contoured F-35 Joint Strike Fighter (JSF) doors and panels tend to require a larger number of boot details to properly conform to the part. Prior to the installation of the boots, the doors and panels must first be prepared for fastener hole location and drilling where the boots are to be installed. The objective of this Composites Manufacturing Technology Center (CMTC) project was threefold: (1) develop technologies to reduce boot details required per door / panel; (2) develop an Ultrasonic Boot Hole Cutting (UBHC) device; and (3) develop an improved boot adhesive system.

Payoff

Significant cost reduction for fabricating and installing boots on F-35 doors and panels has been a payoff resulting from this effort. Estimated cost savings is expected to be $187M for all aircraft. The cost savings will largely be the result of reducing the labor associated with fabricating boots, applying and cleaning up the boot adhesive, and cutting holes in the boots once installed.

Implementation

A successfully demonstrated development effort will be implemented through the F-35 Affordability and/or the Change Request process. The project will return to the Affordability Initiative Review Board for evaluation and implementation funding approval. The project team will submit an add-on effort to finalize the adhesive portions of the project that were unknown at the start of the effort. The project technology is expected to implement in 2016.

Non-Contact Laser Device for Fastener Feature Measurement to Save Costs

A2535— F-35 High Fidelity Fastener Feature Measurement

Objective

The goal of this project was to develop a non-contact laser measurement device for measurement of surface feature flushness on the aircraft production floor. The first step consisted of developing a full set of requirements for a production device. Those requirements were then used to establish initial system parameters and component selection. Module level testing was used to verify that the components selected and the initial algorithms met the requirements set forth. Upon successful completion of module level testing, the full system was developed and tested. Testing of the full-scale system initially consisted of lab scale use and culminated in testing on the aircraft production floor. The final task consisted of manufacturing analysis and planning for the handheld scanner. The system was designed to measure the specific surface feature relative to the profile of the outer skin of the aircraft.

Payoff

This system improves upon current surface measurement processes in terms of measurement quality and measurement time. Previously, only a couple of points on the surface feature were measured, while this system provides the capability to measure the entire surface of the feature of interest. Additionally, the previous system was highly dependent upon operator skill whereas this new system fully characterizes the surface feature without dependence on operator skill, producing a more accurate and repeatable measurement. Upon full implementation, this technology is estimated to result in a total cost savings of over $13M. Finally, the technology developed on this program can be transitioned to other measurement applications providing for an additional estimated cost savings of $13.2M.

Implementation

The necessary steps were taken to ensure that a low-cost method of surface feature measurement was demonstrated that met the requirements of the program and was safe for operator use. A fully functional measurement hand tool was built and proven on production-equivalent aircraft parts. In addition, the cost benefits of adopting the technology on the production floor were quantified via (1) a refined estimate of inspection time and cost savings per aircraft, (2) pricing analysis for the FMT, and (3) evaluation of additional benefits provided by the technology. Implementation is expected late FY16.

PERIOD OF PERFORMANCE:
September 2013 to March 2016

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$492,000

Technology to Reduce the Occurrence of Out of Contour Waviness Defects

PERIOD OF PERFORMANCE:
November 2014 to November 2017

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PEO (JSF)
F-35 Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$2,900,000

A2583 — Smart Processing Manufacturing Technology

Objective

Fighter jet wing and nacelle skins are complex layups produced from carbon bismaleimide prepreg material using the fiber placement process. Highly tailored layups resulting in numerous steep contour changes have resulted in a defect condition called Out of Contour Waviness (OCW). OCW results in costly Material Review Board (MRB) activity and significant effort has gone into determining the root cause of OCW without success. To date, no root cause of OCW has been determined. This Composites Manufacturing Technology Center (CMTC) project will collect the thousands of data points available from each part fabrication and apply pattern recognition and Bayesian methods to identify and understand the variables that effect OCW. Variables identified from this early analysis will then be used to develop a design of experiment (DOE) in which numerous panels will be fabricated and inspected for OCW. Data gathered from this first DOE will then be used to shape a follow-on DOE if it is deemed necessary.

Payoff

The payoff will be identification of variables that contribute to OCW in wing skins and nacelles. If the identification of variables is successful and OCW can be eliminated without impact to production costs, the cost savings for the F-35 Joint Strike Fighter (JSF) program could be as high as $24M. The cost savings is a combination of reduced MRB activity and the elimination of costly steps taken to mitigate the number of OCW occurrences on current production parts.

Implementation

The implementation of the OCW solution on existing parts could take one of several different paths depending upon the root cause of OCW. One of the easier paths to transition would consist of the identification of a series of process variables that needed to be controlled more tightly but within the current process specification. The level of approval required for this type of change would be minimal though the cost to implement would be highly dependent upon the identified variables. One of the more difficult transition paths would consist of specific design features contributing to OCW. The cost of making design changes in a mature product would most likely outweigh the benefits from the elimination of OCW. Future programs in the design change would still benefit from the results of this project. The implementation is targeted for LRIP 10 in 2017.

Automated Material Mixing Procedures to Provide a More Consistent Product

A2587-A-B-— Automated Material Mixing for F-35

Objective

Known automated mixing systems require extensive mixing process development, engineering, testing, and validation in order to meet the stringent material processing and performance requirements for the F-35 Joint Strike Fighter (JSF) materials. The objective of this project is to develop and demonstrate mixing processes utilizing commercially available automated mixing systems to provide more uniform and consistent mixing of filled polymeric materials and to reduce the overall labor associated with the mixing process.

Payoff

Automated mixing of the F-35 material reduces hand-mixing costs associated with the actual labor time to retrieve materials and prepare them for use on the assembly line. Automated mixing also provides a more consistent product improving first-time yield by reducing non-conformance repair activity labor and material. An estimated $34.2M program cost savings is expected to result from this project over the life of the F-35 program.

Implementation

Technology developed by Applied Research Laboratory of Penn State will be evaluated within this ManTech project. Upon successful demonstration of the technology, implementation will be reviewed and funded through the F-35 Blueprint for Affordability program. Implementation costs are expected to be low and implementation is anticipated for 2017.

This project is a joint COE effort between Composites Manufacturing Technology Center (CMTC) and Institute for Manufacturing and Sustainment Technologies (iMAST – Applied Research Laboratory of Penn State).

PERIOD OF PERFORMANCE:
April 2015 to December 2016 CMTC
June 2014 to December 2016 iMAST

PLATFORM:
F35- Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$731,000 (CMTC)
$1,060,000 (iMAST)

Process Improvements to Meet Strict F-35 Primer Thickness Requirements

PERIOD OF PERFORMANCE:
August 2015 to August 2017 NSAM
October 2015 to August 2017 iMAST

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$341,000 NSAM
$500,000 iMAST

A2609 -A-B — Primer Thickness Measurement for Seam Validation & Supply Base Quality

Objective

Various fundamental elements contribute to the establishment of the F-35 as the single most advanced warfighter in aviation history. Several factors, such as an integrated airframe design and the incorporation of innovative materials, contribute to the effectiveness of the F-35. Every detail counts toward achieving the advanced performance capabilities, and tight tolerances are held at every stage of the aircraft assembly. Meeting these tight tolerances has proven to be challenging in terms of manufacturing time and cost and finding accurate measurement technology has proven to be just as difficult. For the F-35, the combination of overly thick primer application and the absence of accurate measurement technology commonly results in failures that require many hours of unplanned rework.

This project aims to develop a method to provide painters with the ability to accurately apply the primer at the correct thickness thereby minimizing the additional costs of rework contributed from deficient panels. The project team will investigate multiple tools/methods capable of proving thickness measurements of the primer coating over composite panels without damaging the primer surface or requiring additional rework. Following a down-select, the preferred technology will then be further developed for implementation into F-35 production.

Payoff

Early estimates forecast a 20 percent reduction in rework activities related to primer thickness. Assuming an LRIP 11 implementation during the first quarter of FY18, the estimated reduction correlates to a per-aircraft savings of $35.5K and a total program savings of over $70M. The project is anticipated to reduce the labor and costs associated with rework, improve first pass quality, and reduce process span time.

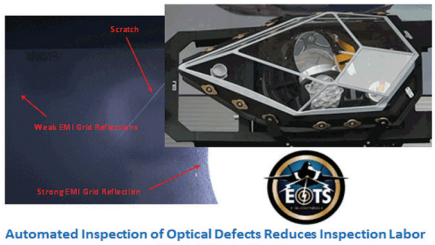
Implementation

This technology will be disseminated to individual part suppliers enabling the supply base to accurately apply and assess the primer coating on their parts prior to shipment, eliminating tedious rework during the later stages of the production process. Accurate measurements of the primer coating thickness will improve first pass quality and eliminate the mandatory rework required for out of tolerance panels. LM anticipates full implementation of the primer thickness measurement technology in LRIP 11 during FY18.

This project is a joint COE effort between Naval Shipbuilding & Advanced Manufacturing (NSAM) and the Institute for Manufacturing and Sustainment Technologies (iMAST)

Automated Optical Inspection for Reduced Cost of EOTS Sapphire Panel Assemblies

A2620 — Optical Evaluation of Sapphire Panels



Automated Inspection of Optical Defects Reduces Inspection Labor and Variability in Results

Objective

The project will develop an automated optical inspection (AOI) system with the goal of pilot production implementation for the F-35 Electro-Optical Targeting System (EOTS) sapphire window assembly. The automated system will be capable of inspecting an entire EOTS window assembly (interior and exterior) and analyzing the data to produce results based on Mil-Spec standard criteria. This project will focus on inspection of gridded / coated sapphire panels assembled in frames and aircraft structural panels as produced in factory; however, the technology developed here is applicable to a variety scratch / dig inspection scenarios.

This inspection approach allows for evaluation of critical functional defects and analysis of their impact on the performance of the entire optical system. Functional defects which diminish the infrared transmission and reduce the sensor imaging performance, which reduce the mechanical strength of the sapphire panel, potentially causing early system failure over the operational lifecycle.

Payoff

Automating the optical inspection task will greatly improve this process by producing repeatable results that are not operator biased while also providing a quality characterization more relatable to system performance over the operational lifecycle. Automated inspection of panels will reduce labor, lower costs, decrease variability, and increase throughput. This technology has widespread applicability to any optical panels where scratch and dig are specified. Therefore, there is a large potential return on investment to develop a flexible system that can be tailored to different optical inspection criteria for multiple applications and programs. There is widespread applicability to many optical panels / windows (sapphire, spinel, ALON, etc.) within existing programs (F-35 bare panels, field and depot returns / repairs) and future systems (Advanced EOTS & Unmanned Carrier Launched Airborne Surveillance and Strike – UCLASS). Acquisition affordability saving of over $4M is projected for the F-35 Program alone.

Implementation

Inspection of EOTS windows assemblies is the pilot process to prove out this automated inspection system. The system will be qualified for use in production of the EOTS window assemblies with validation of successful implementation and benefits payoff. The intent is for the final prototype system to be usable by Lockheed Martin Missiles and Fire Control (LM-MFC Orlando) in production and acceptance of the EOTS sapphire window assembly. This represents implementation by 2017, improving F-35 airframe LRIP 10 (2018 Delivery Year) production costs and rates; EOTS production builds for airframe LRIP 10 are delivered in 2017, one year ahead of A/C LRIP 10 delivery in 2018.

Hardware and software developed under this effort will be utilized for transitioning the automated inspection system to other optical panel / window applications. Automated inspection could be applied to bare sapphire substrates and field return / repair scenarios or any optical panel where scratch / dig validation is required. The plan is to develop a flexible system that can be tailored to different optical inspection criteria facilitating cost savings for multiple applications and programs. Candidate applications will be explored as part of this project, with recommendations for additional transition and implementation opportunities. Other roadmap programs, which benefit include Lockheed Martin's Sniper (Advanced Targeting Pod) system, Advanced EOTS, and Unmanned Carrier Launched Airborne Surveillance and Strike (UCLASS) windows.

PERIOD OF PERFORMANCE:
January 2015 to May 2017

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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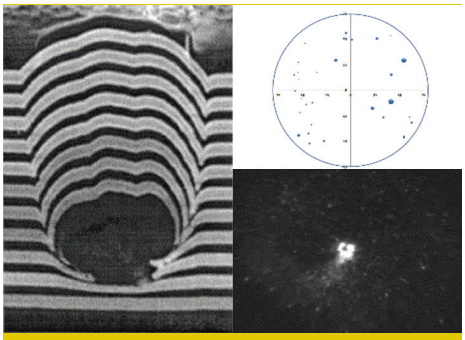
STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$1,924,000

Improving Imaging Systems by Reducing Coating Defects



PERIOD OF PERFORMANCE:
June 2015 to November 2016

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office

TOTAL MANTECH INVESTMENT:
$903,000

A2623 — EODAS Nodule Defect Reduction

Objective

Anti-reflective (AR) coatings are used in imaging systems to reduce reflection and thereby increase transmission or light into the detector. Small defects in AR coatings can create a scatter site for entering light, or completely block one or more detector elements.

AR coating defects can arise from several sources. Imbedded particles which have been over-coated will result in a spherical cap defect on the surface of the wafer. Debris on the surface of the wafer may result from improper handling, storage, or tooling.

Preventing or removing nodule defects and debris on AR coatings could help significantly improve the yield of detector systems. This project has a dual-methods approach: (1) reduce the formation of nodule defects through improved coating process, and (2) develop a laser ablation process for efficiently removing nodule defects without damaging the remainder of the wafer

Payoff

When nodule defects occur, focal plane array performance can be degraded, often through the creation of cluster defects (several adjacent non-functioning pixels). The current mitigation strategy of polishing flatness into the filter wafer can result in scuffing, which can degrade all or most of the FPA wafer.

We are significantly reducing the potential for imaging systems not performing due to AR coating issues. The payoff will be measured as improved yield of focal plane arrays. For F-35, an estimated $6000 per aircraft cost can be avoided through reductions in scrap InSb die

Implementation

The primary transition platform for this project is the F-35 EO/DAS (Electro-Optical Distributed Aperture System) sensor system. The EO/DAS consists of six infrared sensors mounted around the F-35 structure. The infrared sensors are one of the primary cost drivers for the EO/DAS. Once either or both of the two approaches are verified, they will be qualified for production use and implemented in the production line. The technique of laser ablation for nodule defect mitigation could be implemented on any multilayer AR coating.

Continuing to Reduce Costs and Improve Producibility of Infrared Imaging Systems

A2624 — F-35 EOTS Producibility Phase 2

Objective

Continuing the success achieved in the first phase of this project, the Pennsylvania State University Electro-Optics Center (EOC) and Santa Barbara Focalplane are working to improve the producibility of the infrared components comprising the F-35 Joint Strike Fighter (JSF) Electro-Optical Targeting System (EOTS). This follow-on effort to the very successful Phase 1 effort (Project Z2495 – JSF EOTS Productivity Task) consists of two tasks: FPA Quick Test Phase 2 and Improved Dewar Final Vacuum Bake, resulting in cost reductions through process improvements qualified and implemented into production before completion of the project.

Payoff

FPA Quick Test reduces handling and scrap while automation of the Dewar vacuum bake station reduces labor and span time. Benefits include a reduction in cost per unit of 6 percent with improved yields and throughput facilitating F-35 Program production rates and cost targets. Acquisition affordability saving are expected to exceed $33M for the F-35 Program, equating to a return of investment of over 60 for this Phase 2.

With Phase 1 achieving a 19 percent reduction in cost per unit, equating to $117M in savings, the cumulative result is a 25 percent reduction in cost per unit of the EOTS Integrated Dewar-Cooler Assembly (IDCA) with $150M in acquisition savings for the F-35 Program. This represents an ROI of almost 30 for the EOTS Producibility Program.

Implementation

The F-35 EOTS producibility improvements are to be implemented as process changes, qualified and cut-into production before completion of the project. These manufacturing process level changes are only required to go through the normal SBF Process Control Board (PCSB). A sufficient number of production runs will be completed to obtain statistical evidence that the cost and capacity goals can be maintained over long production runs. This analysis and validation will be executed within the confines of the project schedule and will be documented in the final project report.

Implementation by airframe's LRIP 10 expected delivery is in 2018, and EOTS production builds for LRIP 10 expected delivery is in 2017, one year ahead of aircraft delivery in 2018.

PERIOD OF PERFORMANCE:
June 2015 to October 2017

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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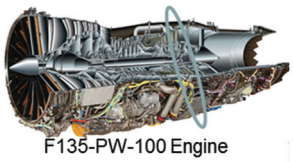
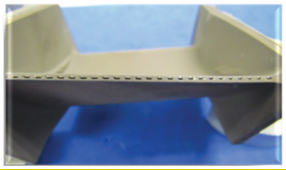
STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$436,000

Automated Manufacturing Solutions for JSF Engine Part to Save Costs and Improve Quality



F135-PW-100 Engine



PERIOD OF PERFORMANCE:
July 2015 to July 2018

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Metals Processing & Fabrication
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$ $2,345,000

A2632 - Automated Turbine Airfoil Trailing Edge Rounding

Objective

A Navy Metalworking Center (NMC)-led Integrated Project Team (IPT) is focusing on the F135 engine turbine airfoil trailing edges, which are typically manually ground to obtain the desired contour. The current process results in high labor costs, as well as deviations in the trailing edge profile that cause both yield and quality concerns. Previous development efforts by Pratt & Whitney (P&W) have demonstrated the capability of a force- and vision-adaptive robotic system to profile grind the blade trailing edges; however, other adaptive grinding processes are potentially viable. The cooling air discharge holes on the trailing edge pose another challenge, as technologies to identify holes and inspect airfoil edges exist, but have not been integrated with adaptive-control methodology. The IPT, comprised of the Joint Program Office, P&W, Alcoa Howmet, and NMC, will develop and demonstrate an automated system to establish the required turbine airfoil trailing edge profiles.

Payoff

The project will reduce acquisition costs by an estimated $14K per engine set based solely on reduced scrap; additional labor savings will be quantified during the project through evaluation/validation of the preferred adaptive grinding solution. This equates to a five-year savings of $16.6M (1,188 engine sets). Additional savings from improved engine performance, reduced fuel burn, and repair are not included. Further benefits may include supporting repair processes and strengthening the industrial base for commercial engines.

Implementation

NMC and industry will generate conceptual designs that will integrate metrology and adaptive grinding or machining technologies. Several solutions will be down-selected for development and assessment. From those, P&W and Alcoa Howmet will determine the preferred automated airfoil rounding solution. NMC will lead the development of the final specification for the full-scale system, as well as the corresponding tooling/fixturing drawings. P&W and Howmet will implement the chosen automated, adaptive grinding or machining solution in FY20.

Improving F-35 Quality and Reducing Cost through Integration and Automation

A2656 — F-35 Assembly Metadata Integration

Objective

The Integrated Assembly Line (IAL) at Northrop Grumman's Palmdale, CA facility contains numerous integrated systems utilized in the production process of the F-35 center fuselage. Each system performs a specific function and occasionally, one of the machines will detect a process that is out of its standard specification and will designate this occurrence as a quality issue. These quality issues are currently generated into hard copy reports and require a significant amount of labor to review, address, and disposition corrective actions for the item. Each report requires significant manual review and coordination, resulting in a high volume of man-hours usage per report to resolve the associated quality issues.

The F-35 program saw the insertion of production rate step increases resulting in an F-35 center fuselage production process interval reduction of 25 percent. This ramp in deliverable requirements will continue until the current four day-per-unit rate is reduced down to a maximum throughput of one day-per-unit in 2019. This escalating production rate will only add to the congestion that is currently present in areas where support functions are required to allocate a significant percentage of their time addressing quality issues.

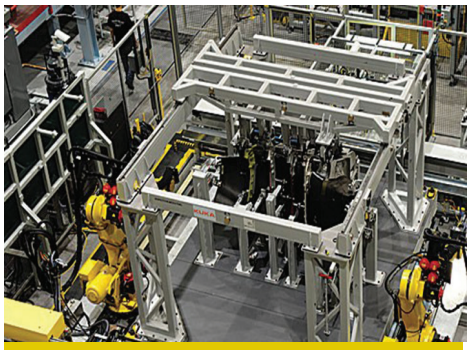
The primary focus of this project is to design an integrated process to extract quality data from key machines on the IAL, which will automate and eliminate tedious review and disposition activities required of current quality processes. This project will also focus on providing sufficient visibility to end users and gradually reducing oversight of non-critical quality non-conformances. To facilitate end user visibility, the improved system will be accompanied by a visualization tool that displays a variety of information based on individual needs.

Payoff

The integrated process is anticipated to reduce the number of man-hours currently utilized for addressing quality issues by 46 percent, resulting in a per aircraft savings of $8.3K. Following a scheduled implementation in 2018, this significant per-aircraft labor reduction will result in a JSF Program savings of more than $17M.

Implementation

The project is anticipated to automate and eliminate tedious review and disposition activities required of current quality processes. Northrop Grumman Aerospace Systems expects to implement the improved process into the production environment in LRIP-11 during the second quarter of fiscal year 2018.



PERIOD OF PERFORMANCE:
August 2016 to October 2017

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$1,933,000

Process Will Reclaim High-Cost Metal By-Product in JSF Engine Components

PERIOD OF PERFORMANCE:
January 2016 to November 2018

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Metals Processing & Fabrication

CENTER OF EXCELLENCE:
NMC

POINT OF CONTACT:
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STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$ 1,528,000

A2689 — Grinding Swarf Reclamation and Reversion

Objective

The Joint Strike Fighter (JSF) F135 engine turbine disks are made from very expensive virgin nickel superalloy forgings. When the turbine disks are ground during fabrication, the swarf (material filings) that is generated contains the nickel alloy as well as cutting oil and media from the grinding disk. Today, this contaminated by-product cannot be reverted into a new forged billet and must be sold as scrap. The Navy Metalworking Center (NMC) is leading a Navy ManTech project that is developing a process to separate and recover the nickel alloy from the grinding swarf, enabling Pratt & Whitney (P&W) to revert the nickel alloy back into new forged billets. This will reduce the amount of virgin nickel material that needs to be procured, resulting in significant material cost savings for the F135 components.

The Integrated Project Team (IPT), consisting of the JSF Program Office, P&W, and NMC, will characterize the various constituents in the grinding swarf generated during the fabrication of the F135 turbine disks. The IPT will also identify the target specifications for the recovered nickel that will result in acceptable metal billets for reuse. The IPT will then conduct an industry survey of waste separation processes used to reclaim various materials, and NMC will lead lab-scale separation trials to develop a process to separate the nickel superalloy from the grinding swarf. With industry support, the IPT will expand on the results from these trials to develop a grinding swarf separation process for use on a production scale.

Payoff

The project is expected to save at least $5.2K per engine, which equates to a five-year savings of $6.18M (1,188 engine sets). P&W further anticipates using the developed reversion process to recover material from other grinding swarf waste streams. This results in a total projected savings of $7.6M over five years, and $13.2M over the life of the program.

Implementation

Once the production separation process has been successfully demonstrated, the team will produce a forged billet using the reclaimed nickel superalloy. The billet will be tested for compliance with the applicable material specifications for the turbine disks. Implementation is planned during fabrication of F135 nickel components at P&W in FY20.

CH-53K Projects

Reliable and Cost Effective Ice Detector System for CH-53K Rotorcraft

PERIOD OF PERFORMANCE:
January 2016 to January 2018

PLATFORM:
CH-53K

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMA 261

TOTAL MANTECH INVESTMENT:
$3,060,000

A2616 — CH-53 Ice Detection Repackaging & Affordability

Objective

The legacy ice detector for the CH-53 utilizes a radioactive isotope that presents an environmental and safety hazard, which is expensive to dispose and replace. The objective of this project is to apply advanced manufacturing and packaging techniques and technology advancements to provide PMA-261 a safe, reliable, and cost effective means of detecting ice accretion for implementation on the CH-53K. This Ice Detector System (IDS) will leverage Guidedwave (GW) technology advancements developed under an SBIR program. The prototype sensor will be packaged into a ruggedized probe using an air-worthy adhesive system. The electronics pulser, receiver, and microprocessor (PRM) will be re-packaged into a compact, air-worthy, commercial off the shelf (COTS)-based, mountable housing that can be adaptable for multiple aircraft platforms

Payoff

A major benefit in acquisition cost reduction and life-cycle support will be derived for this effort, with the implementation of a safe, non-toxic, ice sensing technology for future implementation on the CH-53K. Benefits can also be realized in other rotorcraft or fixed wing platforms for multiple DoD and commercial applications that are subjected to in-flight icing conditions. By implementing COTS packaging and applying advanced manufacturing techniques, the re-packaging of icing sensor prototype will enable a potential acquisition cost savings of $12,000/aircraft for CH-53K for 200 aircraft = $2.4 M. Cost savings could be extended to additional platforms and services such as CH-53E with 180+ aircraft (+$2.2 M). An ROI of greater than 2.0 is expected for the CH-53.

Implementation

This ManTech project proposes to complete the Ice Detection System (IDS) at 24 months ARO. The strategy of this ManTech project can be summarized in three tasks. After reviewing the relevant design requirements for CH-53K, the existing ice detection technologies will be evaluated, including a new guided wave technology developed by FBS Inc. /Guidedwave. This trade study will buy down risk associated with the reliance on the Guidedwave technology by investigating alternative approaches. ACI will use advanced manufacturing packaging to develop the ice detector probe into a form factor designed for CH-53K. The IDS controller will replace the legacy system utilizing advanced manufacturing and miniaturization techniques with a full technical data package (TDP) to allow competitive bidding for manufacturing in the future. The transition event for the project will be the successful completion of the Prototype IDS (passes environmental testing, the final ice tunnel test, and the test results accepted by PMA-261) and the final update to the technical data package for the IDS design. The completed prototype for the CH-53K, will transition to NAVAIR PMA-261 to undergo qualification testing and validation of airworthiness.

Mitigation Technologies to Reduce Distortion in CH-53K Cabin Frames

A2687 — CH-53K Frame Machining Distortion Mitigation

Objective

Distortion that results from manufacturing processes such as machining and heat treating is a challenge for many industries, including the construction of Naval weapons systems. The Navy Metalworking Center (NMC) is working to reduce distortion of the side cabin frames on the CH-53K Heavy Lift helicopter. NMC is leading a Navy ManTech project team that will characterize potential causes of distortion in these parts and then evaluate various technologies to mitigate this distortion. Since distortion is a universal issue, the mitigation technologies developed in this project will potentially benefit other Navy platforms as well. This project will develop and demonstrate mitigation technologies that will reduce a majority of the distortion during manufacturing stages, including machining and quenching.

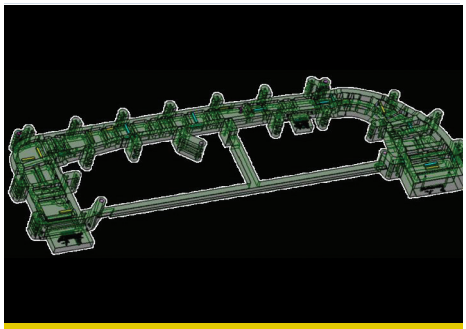
Payoff

The project will provide direct cost savings by reducing manufacturing errors and improving assembly costs. Industry has reported that reducing or eliminating distortion in the side cabin machine frames is expected to save $87K in rework and cost of quality per airframe, with a five-year savings of $6M over 70 units. The anticipated life-of-program savings are projected to be $16M based on 197 CH-53K cabin frames.

Implementation

After successful demonstration, the down-selected technology(ies) will be integrated into the standard manufacturing process at the cabin manufacturer, Spirit AeroSystems.

Implementation is expected during low-rate initial production of the CH-53K Heavy Lift helicopter program in 2018 and full-rate production starting in 2019.



PERIOD OF PERFORMANCE:
December 2015 to November 2017

PLATFORM:
CH-53K

AFFORDABILITY FOCUS AREA:
Metals Processing & Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMA 261

TOTAL MANTECH INVESTMENT:
$1,582,000

Other Sea Platforms Projects

SPS-48E Radome Manufacturing and Slat Refurbishment

PERIOD OF PERFORMANCE:
September 2013 to January 2017

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PEO IWS 2.0

TOTAL MANTECH INVESTMENT:
$735,000

S2487 — SPS-48E Radome Replacement

Objective

Due to Environmental Protection Agency (EPA) restrictions, the original radomes used on the SPS-48E antenna are no longer available due to their Teflon matrix containing perfluorooctanoic acid (PFOA). The goal of this project is to acquire and test the gray, color-matched radome materials from Emerson & Cuming that are potential replacements under a previous project supported by PEO-IWS 2.0.

These radomes will be evaluated based on their dielectric performance, environmental resistances, and color. Along with the radomes, mounting adhesives will be evaluated to ensure minimal interference and suitable bond strengths under an array of environmental conditions. After testing is complete and a radome is found that is directly comparable to the current PFOA-containing painted radomes, a production-scale test will be performed on a SPS-48E antenna.

Payoff

A new radome manufacturer will be identified, allowing continued refurbishment of the SPS-48E as the current old-stock inventory is running low. Without successful execution of this project, refurbishment of the SPS-48E antenna could potentially cease due to a lack of available old-stock materials that can be used to replace damaged or worn-out materials.

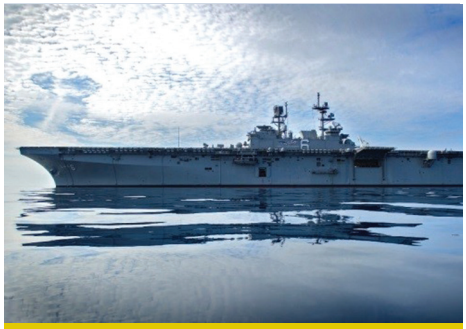
A new adhesive substitute will be identified to reduce the overall cost of both the materials and the amount of labor required to cure the current material. The new material will also be color-matched to the antenna reducing the overall cost of refurbishment. The total costs savings per system will be approximately $185.5K. With 30 systems currently in service, the costs savings are projected to reach $5.55M for one complete refurbishment cycle.

Implementation

Material and new adhesives are being vetted and tested on an antenna build, and they will be qualified using the prescribed matrix necessary to put the new material into field service. This project will transfer technology allowing continued refurbishment of the SPS-48E antenna and the use aboard Navy ships. Implementation is estimated to take place in FY17.

Minimizing Build Strategies Through Modular Outfitting and Packaged Units

S2556 — Modular Outfitting / Packaged Units



PERIOD OF PERFORMANCE:
September 2014 to May 2016

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 377, PEO LHA

TOTAL MANTECH INVESTMENT:
$979,000

Objective

Legacy designs, such as LHA/LHD and DDG 51, date back several decades and have not had the opportunity to invest in an optimized build strategy using current ship design tools and techniques. The current build approach for congested spaces such as machinery rooms, fan rooms, pump rooms, elevators, and other specialized spaces / equipment is cumbersome. Often times, these spaces are outfitted very late in the build schedule (during erection or post launch) where accessibility is limited and demand on support services is higher, making outfitting activities of these spaces more difficult and costly. This Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) project focuses on improving the current build strategy by providing a cost effective process / tool to determine where savings opportunities exist in the construction process. The modular outfitting approach is based upon outfitting as much as possible as soon as possible, in a sequence that makes sense for follow on activities. It typically begins in the early stage of design where functionally related equipment, systems, tanks, etc. are located to reduce the distributed system footage and maximize standardization potential.

This was a two-phased project with the first phase consisting of identifying opportunities for modularity and conducting an impact assessment prior to transitioning into Phase 2. The Phase 2 efforts developed and demonstrated a build strategy tool / process and piloted the tool for validation.

Payoff

The Modular Outfitting project was successful in the development of a tool that provided a standard methodology for identifying opportunities for build strategy changes. The project concluded that changes verified by the tool as potential candidates for pursuing can drive 5 year savings of $2.3M per LHA hull with an additional 5 year savings of $4.2M per DDG and $0.2M for NSC. This effort has provided improvements in productivity and efficiencies, a reduction of outfitting hours, and could improve health and safety conditions for employees.

Implementation

The Modular Outfitting project team developed and demonstrated, through actual examples, a build strategy assessment tool / process which standardized the methodology for evaluating / changing the current build strategy approach for a ship program. The build sequences were examined in detail to identify possible changes to processes and design that could lead to significant cost savings. Ingalls anticipates deploying the solution during the fourth quarter FY16 on LHA 8.

Reducing Support Services Costs Through Temporary Services Optimization

PERIOD OF PERFORMANCE:
August 2014 to February 2016

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 377, PEO LHA

TOTAL MANTECH INVESTMENT:
$568,000

S2557 — Temporary Services Optimization

Objective

Temporary services are identified as services that are required during fabrication but do not sail with the ship. These services provide craftsmen with ventilation, welding lines, electric lighting, power, compressed air, scaffolding, and various other services that are installed, utilized, and removed as craft complete each task. The result is a high number of utility lines leading to disorganized, unsafe, and cluttered passageways. This caused interference, disruption, damage to doors and equipment, and contributed to trip safety hazards. In today's economy, it is crucial that construction costs are reduced for naval ships. Ingalls identified temporary services as an area where money could be saved through additional planning and routing of temporary services and technology insertion. This project at Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) focused on improving the process and/or equipment Ingalls used to provide craftsmen with utility and support services. The project optimized processes and equipment used to provide temporary services during ship construction. The primary focus was on ventilation, scaffolding, and the planning and kitting of temporary services however, the team evaluated all process for improvements.

This was a two-phased project with the first phase consisting of identifying and defining the needs and requirements. Phase 2 allowed the project team to pilot the Temporary Service Optimization areas that showed cost savings opportunities.

Payoff

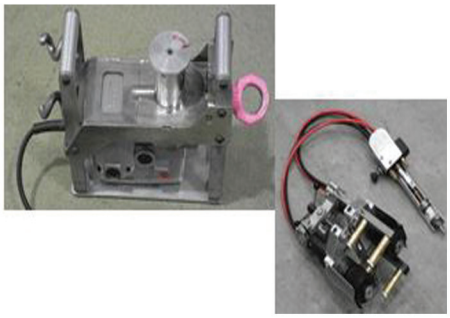
This project reduced the need for excessive utility lines and reduced redundancy, clutter, rework, and increased organization efficiency in each temporary service type. These new technologies and processes were implemented throughout the project as they were developed. It is expected that the newly implemented technology and future enhancements will substantially reduce labor hours for current activities and provide an estimated $732K cost savings per LHA hull with an additional $290K per DDG hull, $104K per NSC hull and $485K per LPD hull.

Implementation

The project examined concepts and processes to provide utility services with lesser footprint and damage, lower cost and disruption with opportunities for technology insertion. Ingalls will update process documents for temporary services (validated by project), purchase new products / technologies (proven by project), and implement new processes and equipment per the developed optimized plan. Several of the process changes have already been implemented and full implementation of the Temporary Services Optimization effort occurred prior to June 2016, which allows for cost savings on a portion of LHA 7 and all future hulls.

Mechanized Tools to Reduce Labor for Pulling Electrical Cable on Surface Ships

S2560 — Mechanized Cable Pulling



PERIOD OF PERFORMANCE:
March 2014 to November 2015

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 377
PEO Ships (AMPHIBS)
NAVSEA

TOTAL MANTECH INVESTMENT:
$1,577,000

Objective

It can take up to 25 workers to pull a single electrical cable on a surface ship, depending on the cable size, length, and routing path. Depending on the cable length and type of pull, the workers may pull an entire length of cable simultaneously, pull portions of the cable short distances until the full length of cable is installed, or most commonly, pull the cable from the middle of the run, in both directions. The objective of this Navy Metalworking Center project was to develop easy-to-use, small, lightweight, portable, power-assisted tools to reduce the amount of time and effort required to pull cable. The project team developed two mechanized cable-pulling tools that have demonstrated the ability to increase efficiency and greatly reduce the physical demand on the tool operators. The air-powered dual roller tool weighs 27 lbs. and is designed to pull cables 1.5 in. to 2.25 in. in diameter with a force up to 450 lbf. With slight modifications, this tool could be adapted for use with cable diameters as small as 0.5 in diameter. The electric capstan tool weighs 29 lbs. and has a maximum cable-pulling force of 2,000 lbf. without cable size limitations.

Payoff

Ingalls anticipates that this project will result in a 20 percent labor savings when using the tools to install Class III and Class IV cables on LHA, LPD, DDG and National Security Cutter class ships. The labor hour reduction equates to a total estimated cost savings of approximately $1.5M, and is based on using the cable-pulling tools on a single hull of each of the programs under construction at Ingalls Shipbuilding (Ingalls). Additional cost savings are anticipated due to reduction in medical claims

Implementation

In addition to purchasing 12 capstans in September 2016, Ingalls intends to procure three more capstans and 15 dual rollers in 2017. A capstan tool and dual roller tool that Ingalls purchased for use in April 2016, Bath Iron Works (BIW) expects to purchase additional capstan and dual roller tools as its proficiency in using the tools increases.

The prototype tools were initially implemented by Ingalls to install cables on DDG 113 and DDG 114. The final prototype tools were transitioned to Ingalls in November 2015 and implemented during installation of cables on LHA in February 2016. Ingalls purchased 12 production capstans for delivery in September 2016. BIW purchased one capstan and one dual roller for use on DDG 116 in April 2016. Newport News Shipbuilding initially plans to purchase one capstan and one dual roller for CVN implementation in 2017 in order to confirm that the tools meet its expectations.

Advanced Hull Production Processes to Save More than $6M for Ships Built at Ingalls

PERIOD OF PERFORMANCE:
March 2014 to November 2015

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NAVSEA
PMS 400D and PMS 500
PEO Ships (AMPHIBS)

TOTAL MANTECH INVESTMENT:
$1,200,000

S2564 — Hull Production Automation Methods

Objective

Most of the production fitting and welding on DDG 51 and Amphibious Assault Ships (LHA) are performed manually using labor-intensive processes. These manual processes often yield inconsistent quality, resulting in construction deficiencies that must be corrected later with additional cost and labor. The Navy Metalworking Center (NMC) led an Integrated Project Team (IPT) to identify high-potential hull fabrication process improvements and to develop, test, and implement the solutions. In particular, the IPT identified and developed hull assembly fixturing, along with automated and / or mechanized processes for layout, cutting, and welding.

Payoff

Improvements to the hull production processes identified are anticipated to result in a cost savings of $6.75M across the DDG, LHA, and Amphibious Transport Dock (LPD) platforms built at Ingalls during a five-year period due to labor savings. Additional affordability benefits will be realized through the improvement of fit-up and consistent, increased weld quality as well as fewer one-time-use tooling, which will reduce material costs.

Implementation

The team developed and down-selected potential solutions for evaluation, including prototype tools and fixtures. NMC also investigated advanced leveling solutions for ship module alignment as well as advanced welding technologies for stiffener collar attachment.

Due to successful shipyard evaluations, implementation of the project solutions began during the third quarter FY15 on LHA 7 and DDG 117. Ingalls has implemented portable jack supports for structures, tee beam alignment tools, ratcheting push-pull tools, and transverse stiffener jacks as well as other tools and fixtures. The solutions were applied during 4Q FY15 to the LHA, LPD, and National Security Cutter hulls under construction at Ingalls. Ingalls has expended capital investments of approximately $1M to integrate project solutions into hull production processes.

Portable System to Mitigate Aluminum Cracking to Provide Significant Cost Avoidance

S2576 — Mitigation of Cracking in Sensitized Aluminum

Objective

Cracks in the superstructure of the CG 47 Class cruisers require extensive repair (i.e., removing and replacing the affected plate as well as all of the outfitting obstructing the area). The Navy Metalworking Center (NMC) led a project to address the major contributor to the cracking – the sensitized microstructure in the 5456 aluminum-magnesium alloy used in the construction of the deckhouse structure. An Integrated Project Team (IPT) developed and demonstrated a portable heat treatment system that reverses the sensitization in 5000-series aluminum alloys, thereby restoring the affected material in the ship's superstructure to a stabilized condition which greatly reduces the propensity for cracking.

Payoff

Reverse sensitization will give the Navy a low-cost alternative to the current process of cutting out and replacing the sensitized plate. The reverse sensitization repair process can save as much as $1.7M per CG 47 ship. The technology could result in a cost avoidance of as much as $25.5M for 15 ships serviced within five years. The Littoral Combat Ship (LCS) program will also benefit from this improved technology at a conservative estimate of $500K avoidance per hull, resulting in an additional $4M in cost avoidance for the LCS hulls in service over the next five years.

Implementation

The process derived from the IPT testing has been incorporated into a portable system that can impart the necessary heat treatment to a shipboard component. The prototype system has been tested on decommissioned CG 47s and on an active duty CG 47 before being turned over to a commercialization partner for use during maintenance intervals. A specification for use of the system is being developed so that additional units may be built after successful implementation. The process is expected to be implemented at Norfolk Naval Shipyard (NNSY) on CG 52 through CG 73 in late 2016.

PERIOD OF PERFORMANCE:
September 2013 to August 2016

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processing

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NAVSEA
PEO Ships (Other)
PMS 406, PMS 505

TOTAL MANTECH INVESTMENT:
$797,000

Additive Manufacturing to Reduce Cost and Lead Time for Electronics Chassis

PERIOD OF PERFORMANCE:
April 2015 to May 2017

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NAVSEA
PEO Ships (Other)

TOTAL MANTECH INVESTMENT:
$1,300,000

S2631 — Distortion Mitigation for Additively Manufactured Electronic Chassis

Objective

The production of monolithic aluminum alloy chassis (or frames) for electronics applications poses several manufacturing challenges. Traditional (subtractive) manufacturing processes and traditional joining processes (e.g., vacuum brazing), when applied to electronics chassis, are hampered by part count, lead time, and manufacturing expense. Additionally, such techniques are not amenable to rapid design modification, testing, and production. Additive manufacturing (AM) has been proposed as an effective means to meet those challenges, but AM is subject to dimensional distortion. To address that challenge, the Navy Metalworking Center is conducting a project to quantify the efficacy of various dimensional distortion mitigation approaches. An Integrated Project Team (IPT) is evaluating factors such as alloy selection, process parameter manipulation, and post-build heat treatment to improve the manufacturability of electronic chassis using AM technologies. This project will identify typical key design features in fluid flow-through chassis, and then design additively manufacture, and test representative aluminum alloy chassis with those features. Testing will include detailed dimensional characterization, tensile testing, hardness assessments, and thermal conductivity measurements.

Payoff

Fabrication of metal electronics chassis using evolving AM technologies offers the Navy the ability to produce new chassis designs with a reduction in total procurement cost and more than 50 percent reduction in lead time relative to the current state-of-the-art, particularly for fluid-cooled chassis requiring internal hermetic fluid channels. In addition, AM of monolithic or modular joined chassis reduces the total part count by 50-90 percent. This part-count reduction results in decreased initial procurement labor and overhead, simplifies assembly of the Line Replaceable Unit, and reduces the hidden overhead costs that propagate through the life-cycle logistics trail. Lastly, with the reduced lead time and direct digital manufacturing approach, the ability for cost-effective, rapid reconfiguration of electronics systems to meet emerging and adaptive threats is significantly improved.

Implementation

Multiple weapon systems are candidates to benefit from the successful outcome of this project. A specific weapon system and implementation timeframe will be selected concurrently with development of initial AM builds. The specific weapon system and timeframe for implementation will be determined by the Go/No-go decision at the end of Task three.

Alternative Materials and/or Manufacturing Processes to Improve Producibility of the Unmanned Undersea Vehicle Fuel Cell System

T2642 — Fuel Cell Producibility

Objective

The Navy Metalworking Center (NMC) is identifying opportunities to improve the producibility and to reduce the manufacturing costs of the fuel cell (FC) system that will be used on current and future Unmanned Undersea Vehicles. Because these vehicles require longer endurance stealthy propulsion systems than the current battery technology can provide, the Office of Naval Research (ONR) initiated a Long Endurance Undersea Vehicle Propulsion (LEUVP) Future Naval Capability (FNC) in FY12 and down-selected a FC stack design solution for further development. Subsequently, UTC Aerospace Systems (UTAS) is developing a FC system for demonstration, but it is manufactured in low volumes for air-independent applications and requires significant manual labor and support resources to process and assemble the hardware. NMC is working with Strategic Analysis, Inc. (SA) and UTAS to provide recommendations to improve the producibility of an advanced FC stack design through alternative materials and/or manufacturing processes.

This project is one of Navy ManTech's Manufacturing Applied Research projects which typically don't meet all of ManTech's normal project criteria as they are higher risk projects with longer transition timelines.

Payoff

Once the Integrated Project Team (IPT) identifies alternatives, SA and UTAS will perform a cost benefit analysis and prioritize the alternatives. Conducting a producibility study of the FC stack design while it is being designed has the greatest opportunity to affect the cost of the system. Design changes can be pursued prior to qualification testing which reduces the implementation cost of alternative technologies in addition to the production cost savings.

Implementation

The transition point for this project is the delivery of the prioritized recommendations to Unmanned Maritime Systems Program Office (PMS 406) and ONR. Follow-on phases of the LEUVP FNC will use these recommendations to modify the design to reduce the cost of the system. Implementation is planned for the initial production run of the vehicle. The FC technology will transition into the naval acquisition program in the FY18-FY19 timeframe.

PERIOD OF PERFORMANCE:
May 2015 to April 2016

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Outfitting

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NAVSEA
PMS 406

TOTAL INVESTMENT:
$400,000

Depot Operation Improvements Initiated for MRAP Structures

PERIOD OF PERFORMANCE:
July 2015 to May 2016

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NAVSEA
PEO Ships (Other)

TOTAL MANTECH INVESTMENT:
$153,000

R2659 — MRAP Improved Crack Repair

Objective

The U.S. Marine Corps (USMC) MRAP assets are going through reset (maintenance and overhaul) operations, where numerous cracks are being identified by the Department of Defense depots. Re-cracking of the high hard steel (HHS) is frequently occurring following the current depot-approved crack repair procedures resulting in increased reset costs and schedule. The Navy Metalworking Center conducted a Navy ManTech Rapid Response project to identify and develop an improved method to repair in-service cracks on HHS armor hull structures utilized for ballistic protection in the upper hull of the Mine-Resistant Ambush Protected (MRAP) Cougar Category 1 and 2 vehicles.

Payoff

Successful development of an improved repair operation was expected to result in more than $13M in cost savings and schedule improvement during the MRAP reset over the next three years.

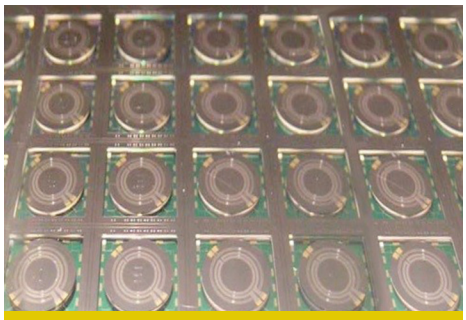
Implementation

While an improved crack repair method was not fully reached, the general improvements for working with and repairing HHS at the depots were identified. Additionally, the project team identified the likely root cause for the cracking issue, supporting the requirement for highly regulated inspection and repair operations.

Implementation of general depot-level improvements (e.g., pre-heating the hull to ambient temperatures before doing any work) has been initiated, and the USMC MRAP office is in the process of funding a new technical manual to better define procedures for repairing HHS MRAP assets.

Manufacturing Process to Yield Higher Production Volumes

T2710 — Manufacturing Process Optimization of Azimuth and Inertial MEMS



PERIOD OF PERFORMANCE:
June 2015 to March 2017

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Electronics Processing & Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PEO (Ships)
NSWCDD

TOTAL INVESTMENT:
$692,000

Objective

There is a need for a high performance MEMS based inertial navigation system which integrates silicon micro sensors with optimized low noise electronics and navigational software to deliver a miniature handheld, lightweight, affordable inertial navigation system, capable of accurate azimuth determination in all environments including GPS-denied. The full navigation system will consist of gyros, accelerometers, navigational algorithms, and electronics capable of integration into a new targeting system, or plug-and-play ability with existing targeting systems.

This project is directed at the production of low cost high quality sensors, which will further the goal of producing a low SWaPC replacement for the Digital Magnetic Compass (DMC). The current Silicon Disc Resonator Gyroscope (SiDRG) fabrication is on 100mm diameter wafers produced in a laboratory environment; this work successfully validated the high level of performance achievable with this device. To achieve reduced component cost at the operational SiDRG level, it is necessary to transition fabrication to a larger wafer size (200mm) in a production environment. The larger wafer size and production environment reduces per-die cost by reducing per-wafer production cost as well as increasing number of die per wafer. The wafer-scale vacuum packaging eliminates the secondary die attach, wire bond, vacuum packaging costs; and allows use of standard low-cost die singulation methods.

Payoff

This project will result in a production inertial sensor meeting the Department of Defense (DoD) requirements for a targeting system used by ground forces. This will allow ground forces to utilize precision munitions, resulting in improved engagement efficiency and reduced collateral damage. The warfighter will gain the ability to engage targets in all environmental conditions including GPS-denied. The sensors will result in a drastic SWaPC reduction, and meet the USMC defined requirements for SWaPC.

This MEMS inertial sensor will be capable of full electronic calibration, without the need for any rotational adjustment (i.e. no moving parts required). The technology is directly applicable to future low-cost miniature, missile guidance control systems, UAV robotic navigation and stabilized weapon systems.

Implementation

The high performance MEMS sensors developed under this project will be incorporated into the Azimuth and Inertial MEMS (AIM) FNC program sponsored by the Office of Naval Research to address azimuth error associated with the DMC. Under the FNC program, the SiDRG sensors will be packaged in an Environment Resistant Package, providing ultra-stable temperature and stress isolation. Boeing will assemble a 3D Inertial Navigation System using the packaged sensors. The navigation system will be characterized for self-calibration, thermal response, and bias stabilization. Under Phase 2 of the FNC program, this advanced navigation system will be integrated into a targeting system for test and evaluation.

Energetics Projects

Real Time Analytical Tools Allow Optimized Process Scale-up of Energetic Materials

PERIOD OF PERFORMANCE:
June 2006 to September 2016

PLATFORM:
Energetics

AFFORDABILITY FOCUS AREA:
Not Applicable

CENTER OF EXCELLENCE:
EMTC

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STAKEHOLDER:
PEO (IWS)

TOTAL MANTECH INVESTMENT:
$6,623,000

S2214 — Flexible Manufacturing of Novel Energetic Materials (Flex NEM)

Objective

Novel energetic compounds have been the focus of the Navy in order to meet the growing demands of its future high performance weapons systems. Some of the work already conducted focused on the development of viable burning rate modifiers. However, in addition to achieving higher performance objectives, insensitive munitions (IM) requirements, as well as compatibility and life-cycle requirements, other concerns needed to be addressed in the development of new energetic ingredients. Several newly synthesized energetic ingredients show great promise as ingredients for explosive or propellant formulations. The objective of this project is to develop a process to produce large-scale quantities of these new ingredients for explosive and propellant formulations.

Payoff

Design and installation of a process using existing 500-gallon reactors will afford significant cost reductions surrounding the processing of the novel energetic ingredients. The scale-up of the chemical processes from previously demonstrated pilot-scales (50 and 100-liter reactors) to the 500-gallon scale will result in 50 percent overall cost reduction per pound for these ingredients and make them available at a scale for formulation and production of explosives and propellants. Process design of a reactor train at the 500-gallon scale will further reduce the manufacturing labor by 85 percent.

Implementation

NSWC IHEODTD has completed site preparation to support manufacture of novel energetic ingredients such as LLM-105, BNFF, and DAFF at a 500-gallon scale. Once process-specific programming and controls are completed, the capability of producing LLM-105, BNFF, and DAFF, and other novel energetic ingredients at the 500-gallon scale for Department of Defense (DOD) weapon systems will exist. This flexible manufacturing capability will have the ability to provide a variety of new energetic material ingredients for use in propellants and explosives.

RAM Technology Provides Safer and Cheaper Manufacturing of Energetic Materials

A2575 — Energetics Production Utilizing Resonant Acoustic Mixing (RAM)

RAM-5 and existing production mixer

PERIOD OF PERFORMANCE:
July 2014 to December 2017

PLATFORM:
Energetics

AFFORDABILITY FOCUS AREA:
Not Applicable

CENTER OF EXCELLENCE:
EMTC

POINT OF CONTACT:
Mr. Charles R. Painter
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STAKEHOLDER:
PEO (IWS)

TOTAL MANTECH INVESTMENT:
$1,489,000

Objective

Resonant Acoustic Mixer (RAM) uses a novel mixing technology developed for the U.S. Army under a SBIR project and patented in 2007. There have subsequently been laboratory-scale investigations of the technology at various labs throughout the Navy and Department of Defense (DOD). In the RAM, mixing is achieved by acoustical energy input to the material rather than mechanical mixing by moving blades. This means that, unlike current mixing, there are no moving parts in contact with the explosive material which provides a significant safety advantage. Existing methods have the potential for friction initiation of energetic material if blades and bowl become offset and make contact or if foreign material enters the mixer and becomes lodged between blades and bowl. This failure mechanism has resulted in past explosive incidents. Replacing mechanical mixing of energetics with resonant acoustic mixing would eliminate this safety hazard. The objective of the project is to develop and demonstrate a small munitions production process utilizing an 80-pound capacity Resonant Acoustic Mixer (RAM-5) to mix the explosive fill.

Payoff

RAM technology offers a number of benefits as compared to current energetics mixing processes. PBXN-110, the explosive fill of the Mk152 Warhead, is currently manufactured using planetary vertical mixers. For example, for PBXN-110, benefits of RAM over vertical mixing include:

(1) safety – as mentioned above, RAM provides a significant safety advantage over vertical mixing; (2) faster production – RAM mixes much more quickly than conventional mixers; (3) reduced footprint, (4) the potential to produce materials not easily processed using current mixing methods (such as materials with higher viscosities and shorter pot lives (solidification times); and (5) reduced costs - evaluation of the labor required for the proposed production process shows a cost reduction of about $100 per warhead at a current production cost of $1500 each. At current production levels, this results in an annual savings of $1M for Mk 152 production, providing a 2.5 year ROI. Additional savings would be achieved as the newly proven technology is used for other existing programs and new work.

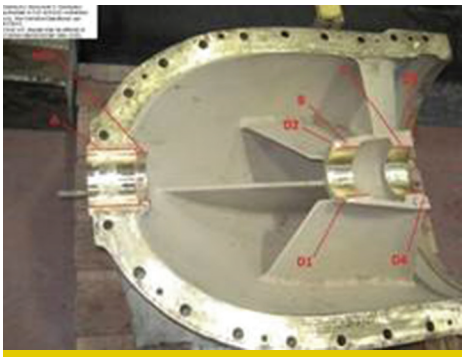
Implementation

The successful completion of this project will result in a fully operational resonant acoustic mixing production facility at NSWC IHEODTD, as well as a qualified RAM production process for the Mk 152 warhead to meet PMA 242 requirements. Direct transition to full production is anticipated following successful FAT results.

Techniques and processes developed will support RAM programs elsewhere. Defense contractors have already expressed interest in partnering with NSWC IHEODTD and utilizing the newly purchased RAM-5. Implementation is targeted for 2.75" IM warheads such as the Mk 152 and Mk 146. PMA 242 has signed a TTP to look at utilizing the RAM technology for full-scale manufacture.

RepTech Projects

Cold Spray Technology for Repair of Shipboard Components to Reduce Costs



PERIOD OF PERFORMANCE:
June 2014 to July 2016

PLATFORM:
RepTech

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication
Coatings

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
NAVSEA

TOTAL MANTECH INVESTMENT:
$600,000

S2580 — Cold Spray Technology for Shipboard Components

Objective

Puget Sound Naval Shipyard (PSNSY) and Intermediate Maintenance Facility (IMF) have identified several repair and maintenance issues on aging seawater-exposed components due to corrosion of the base metal. Components that routinely need to be repaired or replaced include valves, pumps, actuators, and periscope masts. The components are made of different materials including Al-6061-T651, brass, Monel, 70/30 Cu-Ni, and Inconel. Alternative repair processes are needed that are more durable, require fewer man-hours, and are more cost-effective.

The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) effort was to develop cold spray repairs for hydraulic actuators, priming pumps, seawater pump channel rings, and electric motor end bell bore and rotors. Included in the repair process were validation of the process parameters and coating properties, qualification of test results, process parameters, as well as material and coating procedures.

The cold spray process was developed as an alternative for several of the component repairs that were identified. The process can be used on a number of different material systems. The low heat input makes the process ideal for many aluminum and brass components, which cannot be weld repaired due to heat distortion and change in temperature of the base material. In many instances damaged components are replaced and scrapped. Four components were selected for repair by cold spray based on the substrate / coating material combination, urgent need or long lead-time, the number of components requiring repair, frequency of repair, and the potential return on investment.

Payoff

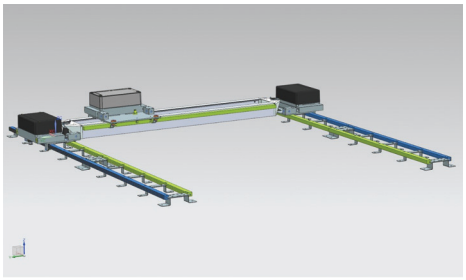
The payoff includes a repair process for components that either do not have an approved repair process, or the repair processes cannot meet the operational requirement. Additional benefits include: improved readiness by repairing long lead-time items, reduced environmental impact, and improved life-cycle affordability. Repairs can be performed at a vendor location, at a naval shipyard, or shipboard. A cost avoidance of over $1.25M has been identified for the repair of aluminum components. Greater savings can be realized through the repair of 70Cu/30Ni, bronze, and brass components. All repairs can be performed using the same cold spray system.

Implementation

NAVSEA leads a regular Cold Spray working group meeting to coordinate Cold Spray efforts and to ensure uniform implementation. Implementation of the repair processes is being performed through PSNSY. Two hydraulic actuator bodies used on subs and a bronze CVN main circulating water pump casing have been repaired using Cold Spray technology. They were approved by NAVSEA for use and are currently in service. A Universal Industrial Process Instruction is being developed for Cold Spray repairs. Repairs of the 70/30 CuNi swing check valve, steel on the motor end bell housing, and a bronze water pump are in the approval process. Final implementation is expected to occur in the first quarter of FY17.

Ultra-High Pressure Water Jet Removal of Special Hull Treatment Using Dual-Track Crawler System

S2599 — UHP SHT / MIP Removal Using Dual-Track Crawler System



Objective

Removal of Special Hull Treatment (SHT) from submarine hulls is performed using ultra-high pressure (UHP) water jet blasting. Currently, shipyards use UHP hand-lances to remove SHT. SHT removal using UHP hand-lances is slow and is a safety hazard for operators. The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) project is to design, fabricate, test, and deliver a dual-track UHP SHT removal system. The dual-track SHT removal system will be a semi-automated process. The dual-track crawler system will use higher pressure and flow rates than can be used with hand-lances. For these reasons, the dual-track crawler system will improve removal efficiency, improve safety, and reduce labor in both the blasting and waste cleanup processes.

Payoff

According to Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNSY&IMF), an estimated 1000 person-hours were expended from April 2013 through April 2014 for SHT removal from submarines using the standard hand-lancing technique. PSNSY&IMF subject matter experts (SMEs) estimate around 35 percent labor reduction will be realized using the dual-track system. These labor reductions result from elimination of the 60-minute operator blast-time restriction (required for safety reasons) and elimination of 'trigger-off' time due to poor visibility.

Vacuum collection is not currently feasible due to the tendency of removed SHT material to clog the vacuum collection equipment. The use of a dual-track system will enable precise control of particle size, which enables vacuum collection at the point of generation. SMEs estimate the shipyards will see a 50 percent reduction in cleanup cost because of the reduced cleanup labor. Finally, SMEs estimate approximately a 35 percent reduction in labor for edge cleanup prior to reinstallation of new tiles.

The estimated total cost savings per hull is $120K per year per yard. The estimated total annual cost savings to the Navy is $360K per year. The return on investment over five years is 3.5:1.

Implementation

The Institute for Manufacturing and Sustainment Technologies (iMAST) plans to demonstrate the system at PSNSY&IMF in the first quarter FY17. The transition path is direct technology insertion at the submarine-supporting shipyards. System complexity is at an appropriate technology level for maximum transition ease.

PERIOD OF PERFORMANCE:
September 2014 to September 2016

PLATFORM:
RepTech

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication
Coatings

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
NAVSEA

TOTAL MANTECH INVESTMENT:
$512,000

Repair of AV-8B Engine Part by Additive Manufacturing will Keep Planes Flying

PERIOD OF PERFORMANCE:
September 2015 to December 2017

PLATFORM:
RepTech

AFFORDABILITY FOCUS AREA:
Metal Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
NAVAIR
PEO (T)

TOTAL MANTECH INVESTMENT:
$600,000

A2647 — Additive Manufacturing Repair of AV-8 LPC Seal

Objective

Additive Manufacturing (AM) is recognized by NAVAIR as a means to bring "…a revolution in how we sustain our systems" (VADM David Dunaway). This technology has clear potential to benefit Navy sustainment activities, including direct part replacement, repair parts fabrication, and refurbishment of worn or corroded parts. The U.S. Navy must develop and demonstrate qualification and certification procedures for targeted components before this potential can be realized for aviation components.

This project will advance AM technology for both new manufacture and repair by developing a qualification test plan, a suitable repair process, and a technical data package to support the qualification, repair, and implementation of AM repair procedures at Fleet Readiness Center (FRC) East. These procedures will address a high-priority repair need within the AV-8B F402 engine—unacceptable surface/fretting wear on the Low Pressure Compressor (LPC) 2nd Stage Rear Seal Ring at bolted contact points to the 3rd Stage Rear Seal Ring.

Payoff

A key payoff will be the reduction in time associated with placing components and systems back into service, resulting in concomitant reductions in cost and addressing critical, improved readiness needs. A Supply Snapshot provided by FRC East suggested that the projected number of surplus seal rings was expected to drop below an acceptable level which would adversely affect the qualification process for a new vendor can take as long as two years.

The cost avoidance and operational benefit associated with the cyclical availability of resources was stressed to the project team from FRC East as motivation to aggressively pursue suitable AM repair options. The knowledge gained through this project will be leveraged by follow-on efforts to further apply the benefits of AM technologies to other Navy applications.

Implementation

Results of this project will be implemented on the aforementioned seal rings when the following conditions have been met: (1) After successful completion of the project, (2) Acceptance of the technology by the Program Office (P.O.) and/or Program Executive Officer (PEO) and/or the Management Representative of the Industrial Facility, and (3) Acceptance by the relevant Navy Technical Code.

Low Loss Launch Valve Improvement

S2682 — Low Loss Launch Valve Plug Maintainability Improvement

Objective

The Low Loss Launch Valve (LLLV) in the steam catapults TC-13 MOD1 and MOD2 are deployed on CVN 68 through CVN 77. Each catapult has a LLLV which precisely meters the proper flow of steam to the power cylinders for aircraft launch. The plug-type valve rotates to control the flow of steam. The area on the plug shaft just below the steam plug valve is coated to increase the wear and corrosion resistance of the LLLV. The coated area is exposed to high temperature condensate from the steam. The two- part coating system is applied using a thermal spray process. The system consists of a metallic bond coat and a ceramic top coat. There currently is a maximum approved coating thickness. During refurbishment of the LLLV, the coating must be removed from the shaft. Additional machining is performed to remove any material affected by the coating process. The removal of the additional material results in an undersized shaft. The coating can be used to restore the shaft to the required diameter. The maximum approved coating thickness limits the amount of material that can be applied to the shaft.

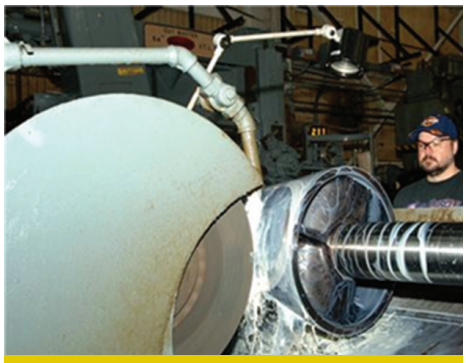
The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) effort is to increase the thickness of the coating system while meeting or improving the adhesion strength and corrosion resistance. Initial efforts will focus on increasing the thickness of the bond coating by 50 percent using the same plasma spray process and the same vendor. Adhesion, microstructural analysis, and corrosion tests will be performed to determine if the coating meets the performance requirements. Other coating systems and processes will be examined if needed. Representative hardware will be developed to validate the repairs. Improvements to the plasma spray process will also be investigated.

Payoff

The payoff includes a process that can be used to restore undersized LLLV plug shafts to the required diameter, increased corrosion and wear resistance, and an improved plasma spray process for applying the coatings. The cost of a new LLLV plug shaft is $100K. Six shafts are repaired annually. The cost savings for repairing the shafts over purchasing new shafts and for increasing the life of the LLLV plug shaft is $500K per year. Additional benefits include: extended time between repairs, an improved process for applying the plasma spray coating to the LLLV plug shafts, and a method for reclaiming undersized plug shafts. An improved plasma spray process could be used on other Navy assets as well.

Implementation

Implementation of the repair processes will be through Naval Air Warfare Center Aircraft Division - Lakehurst and the plasma spray vendor. Implementation will included test methods to validate the performance of the thicker plasma coatings. Final implementation is expected to occur in FY18.



PERIOD OF PERFORMANCE:
February 2016 to September 2017

PLATFORM:
RepTech

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication
Coatings

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 378
NAVAIR

TOTAL MANTECH INVESTMENT:
$250,000

Wire Support Spring Improvements for CVN

PERIOD OF PERFORMANCE:
March 2016 to September 2016

PLATFORM:
RepTech
CVN

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 378
NAVAIR

TOTAL MANTECH INVESTMENT:
$75,000

R2713 — CVN Arresting Cable Spring Support Structural Integrity Improvements

Objective

NAVAIR has purchased numerous wire support springs from the same vendor for a number of years. Recent failures of the wire support springs have become a serious problem for damage to a single aircraft can be as high as $500K. Springs from recent buys have been failing prematurely compared to earlier lots. The wire support springs break into pieces indicating brittle failure. Failed springs can result in damage to aircraft and are a safety hazard to flight deck personnel. The cause of the failure is under investigation.

This project focused on three specific lots of wire support springs. These lots were selected from input provided by NAVAIR, Lakehurst. The first lot was purchased in 1998, the second lot was purchased in 2004, and the last lot was purchased in 2010. The wire support springs from the 2004 and 2010 have been failing at a higher rate and after fewer arrests than the springs purchased in 1998. Springs from all the lots passed the standardized qualification testing, and no methods have been identified to determine which springs will fail. The rate at which springs fail is increasing and there is a need to purchase another lot without specific assurance that suspect metal will again enter the inventory. A resolution to the spring failure issue is to ensure that spring material is produced with the required properties.

The objectives of this effort were to determine the cause of failure of the wire support springs and develop a mitigation strategy. The failure analysis included microstructural characterization, x-ray fraction, and energy dispersed spectroscopy, high strain rate testing as well as a review of the heat treating and tempering cycle. Ultrasound and eddy were investigated as methods to identify springs from the different lots of material. The goal was to be able to return existing stocks of springs to safe function, thereby saving funds, and significantly improving availability to the Fleet.

Payoff

The payoff includes reduction of premature spring failures, increased safety for aircraft and flight deck personnel, reduced cost to replace damaged springs, and a method for identifying springs from the different batches.. The annual cost avoidance is estimated at $260K per year, not including repair to damaged aircraft.

Implementation

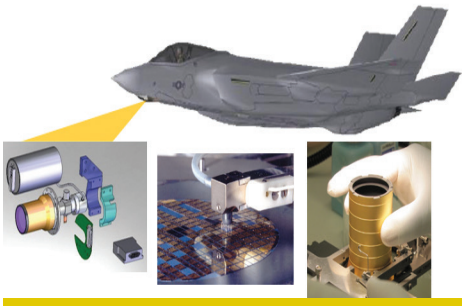
Implementation of the improved wire support spring manufacturing process will be through NAVAIR Lakehurst working with the spring vendor. The NDE method will also be implemented at the spring vendor and at Lakehurst. Process modifications such as changes in the heat treat or temper cycle will be implemented at the vendor. Final implementation is expected to occur in FY17.

DOD ManTech Projects

Note: The projects included in this section are projects funded not out of the Navy ManTech line but out of the Manufacturing Science and Technology (MS&T) Program (the DOD ManTech line).

The Defense-wide Manufacturing Science and Technology (MS&T) Program was mandated by Congress in Section 241 of the National Defense Authorization Act of 2006, under the authority of Section 2521 of Title 10, to identify and transition advanced manufacturing processes and technologies that would achieve significant productivity and efficiency gains within the defense industrial base. The program complements the Service and Agency Manufacturing Technology programs by focusing on multi-service DOD priorities which are identified and ranked through roadmapping and data call activities conducted in collaboration with DOD and industry manufacturing representatives.

Automated Process Improvements to Improve Throughput and Reduce Costs for F-35 EOTS Production



PERIOD OF PERFORMANCE:
July 2016 to January 2019

PLATFORM:
DOD ManTech F-35-Joint Strike Fighter

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
F-35 Joint Program Office (JPO)
DOD Air Force Research Laboratory

TOTAL INVESTMENT:
$704,000

Z2681 — F-35 EOTS Producibility Phase 3 (AFRL)

Objective

The Electro-Optical Targeting System (EOTS) of the F-35 Joint Strike Fighter (JSF) is a high-performance, lightweight, multi-functional system for precision air-to-air and air-to-surface targeting. It provides high-resolution imagery, automatic tracking, infrared-search-and-track, laser designation with range finding and laser spot tracking. Production of the EOTS Focal Plane Array (FPA) sensing element and Integrated Dewar Cooler (IDC) suffers from inefficiencies making them unable to meet full-rate quantities at cost bogeys. The Air Force Research Lab (AFRL) has identified the following tasks for continued improved of the EOTS Producibility Program: (1) Cold Stack Automation and (2) Automated Die Cleaning and Inspection.

The subcontractor and implementing organization, Santa Barbara Focalplane (a Lockheed Martin Missiles and Fire Control Company), will develop, qualify, and implement these automated process improvements before completion of the project. A sufficient number of production runs will be completed to obtain statistical evidence that the cost and capacity goals can be maintained over long production runs.

Payoff

These tasks address a high priority defense need -- providing cost savings (reduced touch time) and improved throughput (reduced span time) while facilitating less expensive (reduced cost per unit) LRIP and full rate production. This project addresses manufacturing technology beyond normal risk of industry, where SBF can hit production rates but at significant cost to the Government. Together, these tasks are expected to provide over $5M in F-35 Program acquisition affordability cost savings.

Implementation

Santa Barbara Focalplane, will develop, qualify, and implement automated process improvements with benefits, including cost savings and capacity improvement, fully characterized before completion of the project. The implementation is targeted for F-35 EOTS production.

Process qualification is paid for by this project with the F-35 Program Production Contract paying for training and implementation into the EOTS production line. The solutions will be implemented as process changes with the improvement qualified, 100 percent cut-into F-35 EOTS production, and benefits characterized by the completion of the project period of performance.

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