…transitioning affordable manufacturing technology to the Fleet

2016 Navy ManTech
PROJECT BOOK

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2016 Navy ManTech Project Book: This 2016 edition of the Navy ManTech Project Book provides brief write-ups for most of the Navy ManTech projects active in FY15. 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.

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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, a new addition in FY16 and out, 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. 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. 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.

Navy ManTech is continuing our focus on implementation and risks to implementation. Our 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 updates semi-annually 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, show good cost reduction potential, and ManTech's transition rate for projects continues to increase.

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 the past ten years, the Navy ManTech Program has been focused on affordability improvements for key acquisition platforms. The platforms ManTech is currently focused on include the VIRGINIA Class Submarine (VCS)/OHIO Replacement (OR), DDG 51 Class Destroyer, CVN 78 Class Carrier, the Joint Strike Fighter (JSF), and, new in FY16 and out, 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 36 of the portfolio's approximately 80 projects have been implemented for a resulting real acquisition cost savings of over $32.5M 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 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). The CH-53K Heavy Lift Helicopter has been added recently to the ManTech investment strategy as an affordability target for FY16 and out.

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.

Navy ManTech Investment Strategy

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.

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.

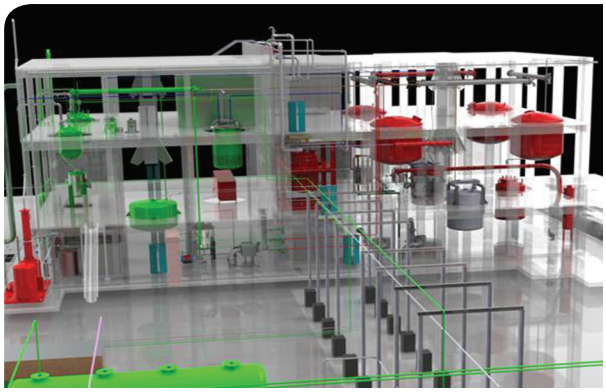
In FY12, Navy ManTech expanded and formalized its focus on implementation and risks to implementation by instituting an Implementation Risk Assessment Management Process to assess potential future projects (those in the planning stages) as well as ongoing projects. For ongoing projects, risks are discussed 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

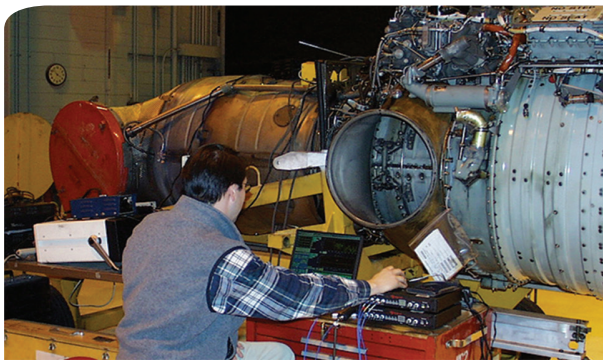
While the large majority of annual ManTech Program resources are invested in accordance with the affordability investment strategy, Navy ManTech does support smaller efforts in Energetics and Repair Technology (RepTech).

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 of Points of Contact Directory.



(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 of Points of Contact Directory.



(Courtesy of iMAST)

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.

Navy ManTech Execution

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 35 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 edge research with on-time and on-budget deliveries.

EOC Web site: http://www.eoc.psu.edu

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

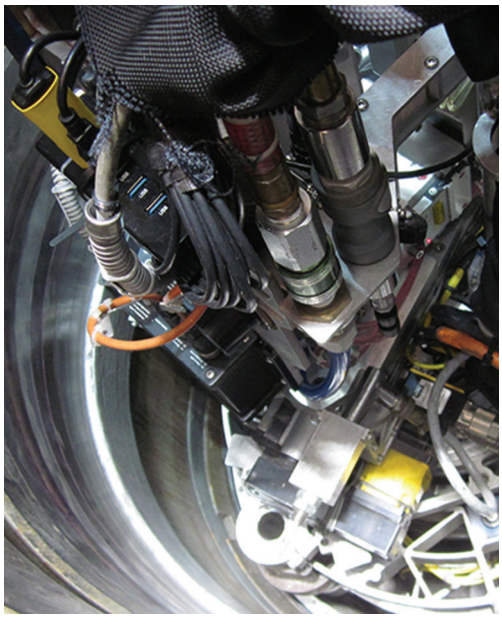
EMTC Web site: http://www.navsea.navy.mil/nswc/indianhead/codeCA/EMTC/main.aspx

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)

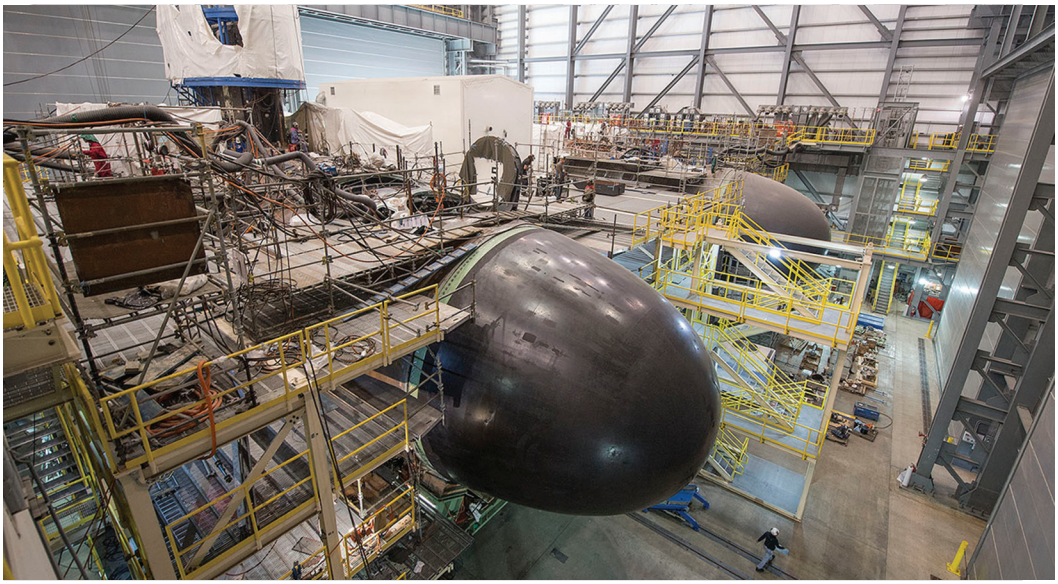
Navy ManTech Execution

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



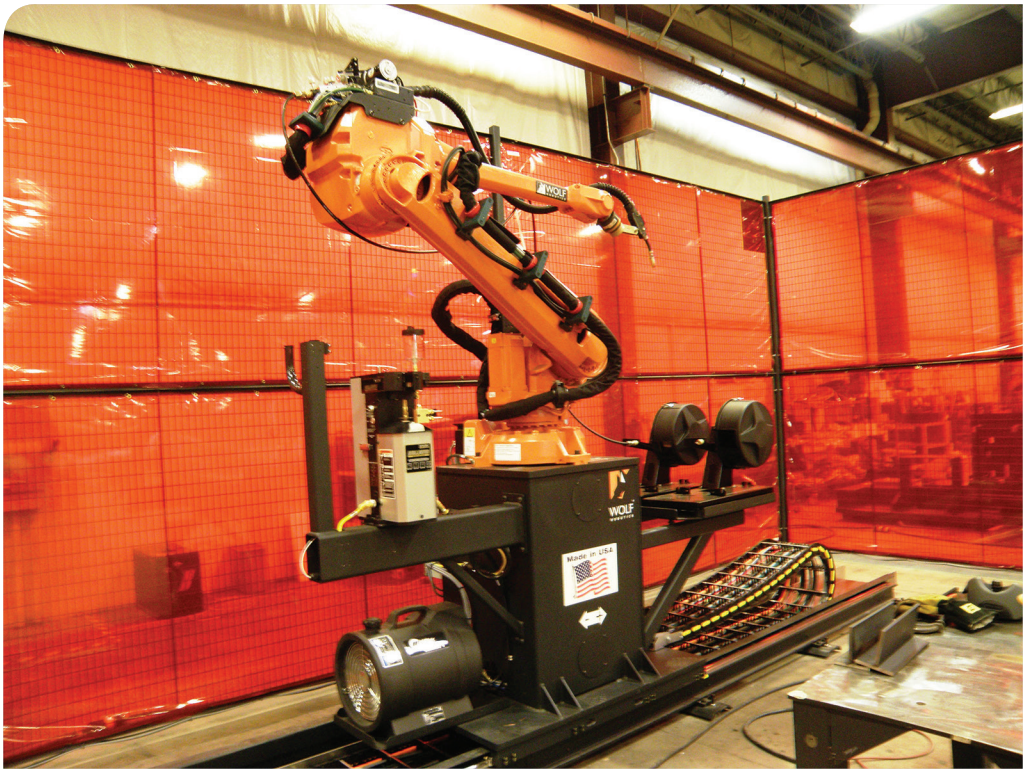
(Courtesy of NMC and Newport News Shipbuilding - A Division of Huntington Ingalls Industries)

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



Improving Weld Production Through Robotics (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. The goal of developing and implementing new and improved technologies will be 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 of the Navy ManTech Points of Contact Directory.

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

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 Partnering on

(Courtesy of Huntington Ingalls Industries - Ingalls Shipbuilding)

The Arleigh Burke Class destroyer has long been a mainstay of the U.S. Navy since the program's start in the late 1970s. With its focus on providing air defense to the fleet, the ship class now numbers 72 ships (through FY15 procurements). In FY08, when the Navy made the decision to halt construction of the DDG 1000 destroyers and restart construction of DDG 51 class ships, the Navy ManTech Office refocused its efforts to support the restart of this program by initiating ManTech's DDG 51 Affordability Initiative to provide needed manufacturing technology support to Huntington Ingalls Industries - Ingalls Shipbuilding (HII-Ingalls) and Bath Iron Works (BIW) for DDG 51 cost reduction.

Over the past years, extensive interaction and cooperation between Navy ManTech, the COEs, HII–Ingalls, BIW, and PEO (Ships) has resulted in a focused ManTech initiative that is starting to successfully implement manufacturing technology for significant affordability improvements for DDG 51. Using HII-Ingalls as an example, their current DDG 51 ManTech portfolio contains over 30 projects totaling $31 million in Navy ManTech investment and has a potential cost savings of over $17 million per hull. Recent input from HII-Ingalls shows that, to date, ten projects have completed and have either been implemented or are in the process of implementation for a realized cost savings total of over $7 million per hull against their projected $17 million per hull total (Sep. 2015). Projects range from improvements in shipbuilding processes, planning and scheduling, efficient outfitting of assemblies, and automation of processes to design-to-shop floor communications.

Recent projects with large resulting cost reductions include: Improved Stud Fixturing Processes; Development of Technical Requirements for Mobile Supervisor; and Machine Readable Material Transactions. In the Improved Stud Fixturing Processes project, the stud welding process was adapted to minimize stud size and maximize mechanical performance for specific mounting applications to reduce cost in the mounting of equipment. Cost savings for DDG 51 is projected at $1.714 million per hull, but the technology is applicable to the full range of Navy ship acquisition programs. In the Development of Technical Requirements for Mobile Supervisor project, three system functions were piloted – mobile timekeeping, material inspection, and paperless records and maintenance for operations. The project focused on mobile technology and process improvements to enhance

Cost Reduction for DDG 51...

efficiency and optimize both supervisory and craft productivity for a cost reduction of $2.275 million per hull. Through development provided by the Machine Readable Material Transactions project, HII – Ingalls is introducing an automated tracking system that will facilitate traceability and accountability of material transactions throughout construction for a cost savings totaling $1.925 million per hull.

Recognizing the benefit of a continued strong relationship between HII-Ingalls and ONR ManTech, Kevin Jarvis, Director of Shipyard Integration at Ingalls Shipbuilding states that,

"The ONR Ingalls partnership has resulted in innovative approaches, new technology insertion and cost saving process improvements to our shipbuilding portfolio. Working with ONR and the ManTech Centers of Excellence has allowed Ingalls to develop and pilot projects to assess the benefits and reduce our risk of implementation by maturing concepts on the production floor. The ManTech program has been successful at Ingalls and made us a more efficient shipyard. Ultimately PEO Ships is reaping the benefits of these efforts."

Navy ManTech is proud of its work with HII-Ingalls on cost reduction for DDG 51 construction and is looking forward to continued success in identifying, developing, and transitioning needed manufacturing technology to Ingalls Shipbuilding for implementation on the factory floor as well as exploring innovative long-term strategies to provide cutting edge technology and processes for the Navy shipbuilding industry.

(Courtesy of Huntington Ingalls Industries - Ingalls Shipbuilding)

CVN 78 Class / Carriers Projects

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Composite EHF Antenna Platform to Improve Frequency Response

PERIOD OF PERFORMANCE:
March 2013 to October 2015

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@scra.org

STAKEHOLDER:
PMS 378, PMS 379
PMS 312

TOTAL MANTECH INVESTMENT:
$1,612,000

S2475 — CVN Composite EHF Antenna Platform

Objective

Many satellite communication antenna platforms on Navy ships are experiencing excessive vibration due to resonance with the supporting structure. This excess vibration causes the antenna to constantly compensate for the vibratory motions (tracking) and eventually results in system failure and increased support costs. As an alternative approach to meet the stringent EHF design goals, the objective of this Composites Manufacturing Technology Center (CMTC) effort was to develop an all-composite EHF platform configuration and evaluate analytically. Antenna platforms offer significant opportunity for composite applications on CVN aircraft carriers. The specific stiffness of composites, particularly of carbon laminates, allows the implementation of structures with a high resonant frequency such that ship vibration does not excite antenna platform modes.

Payoff

The benefits of this project focused on reduced maintenance costs, reduced weight, and reduced fabrication and assembly costs. The key benefit is an estimated $208M cost savings due to reduced motor burn-up on the antennas. A 30 percent weight reduction over the steel platforms will also be realized with further development. This technology does have applicability to other cantilevered platforms throughout the Navy.

Implementation

Implementation of this project could occur on the CVN 79 EHF radar platform if implementation money is available. Back-fit to previous classes is possible with a redesign of the platform. The In-Service Carrier group has been engaged to ensure the testing and development within the ManTech project accounts for all platform needs for both the CVN 68 Class and CVN 79 Class. Testing performed on the project validated that composites will not only meet performance requirements but will exceed requirements.

Improved Flexible Infrastructure Track System to Save Costs for CVN and Other Surface Ships

S2517 — Flexible Infrastructure Track System

Objective

The Flexible Infrastructure (FI) track system is a series of extruded and machined aluminum tracks attached to a ship's deck structure, creating a false deck, enabling equipment to be mounted without the use of hot work, and allowing rapid rearrangement of the space to meet changing missions. The large tracks (>20,000 linear feet on a typical CVN installation) are difficult and costly to manufacture. The Navy Metalworking Center (NMC) led an Integrated Project Team (IPT) to improve the manufacturability of the FI track system. The IPT pursued a dual solution improvement approach whereby "I-beam pedestal" and "hex bar standoff" track improvement concepts were developed. The IPT fabricated and tested prototype track components and produced FI track fabrication and installment drawings to support procurement of this improved system. The IPT also evaluated a prototype installation fixture to improve the overhead installation procedure given the improved overhead track design. The improved FI track system accommodates multiple deck heights (6", 8", 9", 10", 12", and overhead track) and the majority of deck frequencies for a cross-platform solution.

Payoff

This project is expected to save $4.8M over five years for CVN 79, LHA 7 and 8, LPD 28, LXR, and CVN 73 overhaul based on track extrusion and machining savings, along with labor savings on the overhead track installation. The improved track system reduced complexity and size of the extrusion and reduced extrusion lead time, rejection rate, and rework. Also as a result of this project, an increased number of vendors are capable of extruding track, allowing for competitive bids.

Implementation

Implementation of the new FI track system is expected during the second quarter of FY16 on CVN 79 and CVN 73 overhaul at Huntington Ingalls Industries – Newport News Shipbuilding (NNS). Other program-specific Technical Warrant Holders and Program Office approval requests will follow as program schedules dictate.

PERIOD OF PERFORMANCE:
October 2012 to June 2015

PLATFORM:
CVN Class / Carriers

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378, PMS 379

TOTAL MANTECH INVESTMENT:
$1,207,000

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

PERIOD OF PERFORMANCE:
September 2014 to February 2016

PLATFORM:
CVN Class / Carriers

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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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, it is proposed that the composite shells of the RCCs 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

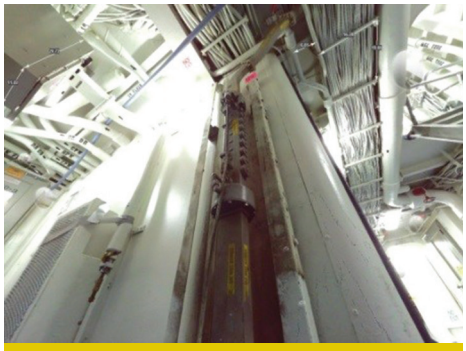
The principal benefit of this project will be life-cycle savings while reducing acquisition costs or remaining cost- neutral. The project is estimated to save $37M in total, resulting in an ROI of 25:1. The fabrication approach will save production time and, while the RCC is not on the critical path,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

Reducing Shipcheck Planning Cost Through the Use of 3D Reality Capture

S2542 — CVN 73 Reality Capture



PERIOD OF PERFORMANCE:
November 2013 to April 2015

PLATFORM:
CVN Class / Carriers

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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PMS 378, PMS 379, PMS 312

TOTAL MANTECH INVESTMENT:
$548,000

Objective

One of the barriers to quality design output related to ship alterations to the aging fleet is the lack of accurate as-built configuration data. Traditional shipcheck operations involve significant travel, labor, and material cost. Shipcheck operations on CVN 68 Class aircraft carrier overhauls can involve as many as 1500 compartments. Resulting data is subject to human error and becomes a foundation for outdated design processes. Engineering product quality is heavily dependent upon accurate shipcheck data. Current engineering space management is manually derived. System interdependencies are reliant upon constant coordination and interaction between the disciplines which further drives up cost in planning and execution. Huntington Ingalls Industries - Newport News Shipbuilding (NNS) evaluated laser scanning technology to reduce planning cost for Navy fleet modernizations and repairs. The project's objective was to develop a plan to transition 3D scanning and design technologies into NNS engineering planning production processes. Technologies and processes identified in the transition plan will illustrate a potential reduction in shipcheck travel and labor cost while adding capability to accurately develop engineering products within a 3D design environment. These updated technologies and processes have led to cost reductions in required maintenance and repair planning while adding capability to accurately develop engineering products within a 3D design environment.

NNS executed this project using an iterative process with incremental implementations. To accomplish project goals, NNS conducted shipcheck trials, developed processes and procedures, developed 3D asset libraries, and prototyped tools and processes during the initial CVN 73 shipcheck. This effort led to an additional prototype being developed, with NNS testing the technology during the next shipcheck evolution. This project provided NNS with an opportunity to implement technology and develop effective processes, establishing the basis for improving all aspects of shipcheck operations. These new processes affect nearly every phase of engineering and planning processes.

Payoff

This technology is expected to improve safety and reduce human error, provide access to shipboard reality prior to ship arrival, facilitate 3D and 2D design automation, improve overall quality of design products, and utilize composite models for developing better ship alterations. The process changes will reduce ship check costs for CVN repair planning evolutions and expect to save $1.8M.

Implementation

The technology and updated processes have been transitioned to the CVN program at NNS. Implementation, which occurred prior to project end, consisted of large-scale reality capture capability with enterprise-wide access to scan data to support planning efforts on CVN 73 RCOH. Enterprise infrastructure to support reality capture data and subsequent utilization has been fully deployed.

Enabling Earlier Outfitting Expected to Save CVN 79 Construction Costs

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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PMS 378, PMS 379

TOTAL MANTECH INVESTMENT:
$1,230,000

S2561 — CVN Vertical Build

Objective

A Navy Metalworking Center (NMC) project is expected to significantly reduce overall construction costs for CVN 79 by identifying pre-outfitting that can be completed at a more optimal period of ship construction. The build strategy for CVN 78 required much of the ship outfitting activities to be completed after each section had been joined or erected to the rest of the ship under construction in the dry dock. As a result, much of the outfitting work was completed in enclosed areas that were difficult to access by workers and rigging equipment (e.g., cranes and forklifts) and where the labor frequently conflicted with other work in the shared space. An NMC-led Integrated Project Team (IPT) identified targeted systems and specific construction areas of CVN 79 that could benefit from pre-outfitting concepts, which improve construction efficiencies targeting cost reductions. In addition, the IPT benchmarked the best practices of other shipbuilding programs and commercial industries through literature searches and site visits. The project also identified systems and subsystems for rafting and developed structural concepts for construction in shops, rather than concurrent with structural assembly.

Payoff

The IPT produced a Business Case Analysis that identifies the benefits, including an expected cost reduction from efficiencies gained from optimized outfitting activities. In addition, completed spaces might be ready for turnover earlier in the construction process, possibly even prior to erecting the unit onto the ship.

Implementation

Implementation of the project's recommendations will occur when pre-outfitted superlifts are erected in the dry dock on CVN 79 at Huntington Ingalls Industries - Newport News Shipbuilding (NNS) beginning in the first quarter of FY17.

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

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 (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 24-month 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 33,000 hours and reduce CVN acquisition costs by an estimated $3.42M 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.

PERIOD OF PERFORMANCE:
August 2014 to August 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

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

S2582 — Improved Weapons Magazine C-Channel

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:
$1,440,000

Objective

This Navy Metalworking Center project will improve 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. The legacy welding procedure induces channel distortion that requires rework. In addition, access is difficult when applying surface coating to the C-channels. This project will reduce the overall installation hours and the associated costs to manufacture and install the WMTDS. The Integrated Project Team (IPT) examined both Huntington Ingalls Industries (HII) - Newport News Shipbuilding (NNS) and HII - Newport News Shipbuilding (NNS) and Ingalls Shipbuilding (Ingalls) installation processes and explored improved manufacturing and installation processes. The IPT is developing and evaluating several concepts, constructing prototypes, and using the prototypes to validate the process improvements.

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. In addition to cost savings, the standardized WMTDS solution is expected to improve first-time quality and final preservation (surface coating). Finally, this project will result in a standardized installation approach for a cross-platform solution.

Implementation

The IPT will develop and evaluate several WMTDS improvement concepts to ensure all requirements are met and to identify potential fabrication and installation challenges of each candidate. The IPT will analyze the selected improvements to ensure compliance with the structural system requirements, and construct and evaluate prototype(s) to validate the process improvements. NNS and Ingalls will request approval from the Technical Warrant Holders and Program Offices to implement the improvements with supporting data generated from this project. The implementation target is the fourth quarter of FY17 on LHA 8 at Ingalls and the third quarter of FY19 on CVN 80 at NNS.

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, Huntington Ingalls Industries (HII) - 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 HII - 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 to develop and modify a prototype automated visual inspection system and will demonstrate it in a production environment for expected use on CVN 80. Implementation is planned in August 2016. Secondary implementation is planned in 2016 for the pre-construction primer line at Ingalls in support of DDG 51 and LHA.

PERIOD OF PERFORMANCE:
August 2014 to July 2016

PLATFORM:
CVN Class / Carrier

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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PMS 378, PMS 379

TOTAL MANTECH INVESTMENT:
$1,403,000

DDG 51Family Projects

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

S2385— Continuous Wave Illuminator Transmitter Upgrade

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

TOTAL MANTECH INVESTMENT:
$7,435,000

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.

Streamlining the Installation of Fiber Optics

S2437 — Fiber Optic Installation on Ships

Objective

Use of optical fiber is increasing aboard ships as onboard systems require additional bandwidth for data communications. Fiber optic cable is lighter in weight and more flexible than electrical cable - an additional benefit that sometimes results in damage during installation.

The objective of this project was to reduce the costs associated with optical fiber installation, with focus on the Huntington Ingalls Industries - Ingalls Shipbuilding and Newport News Shipbuilding yards. The project developed specific designs and installation processes that maximized first-time acceptance of fiber optic data networks. To optimize the manufacturing process of shipboard fiber optic network lines, the complete process – from the initial system design to final installation and testing – was evaluated. Processes including cable routing, installation sequences, connector assembly, and test methods were evaluated for improvements. Commercially available equipment and hardware were included in the evaluation.

The overall project outcome was to improve installation processes designed for efficiency and performance. In addition, this project included the evaluation of an increased share of single mode fiber, which has an extremely high bandwidth but requires more challenging physical tolerances.

Payoff

Improvements to installation methods increases first-time quality and reduces cost and schedule impacts associated with rework. New and improved installation methods are enabling Ingalls Shipbuilding to meet system requirements of new ship programs. The expected cost savings of $600K per DDG 51 hull has been met by the implementation of the improved installation methods. Additional cost savings are possible with a future design change as well.

This project is applicable to all ship programs at Ingalls Shipbuilding and eventually Newport News Shipbuilding.

Implementation

Implementation, (i.e. the documentation and production process updates) was performed at the Ingalls Pascagoula shipyard. Deployment updates have been incorporated into shipyard manufacturing procedures. It is expected that engineering changes will be ready during 2016.

PERIOD OF PERFORMANCE:
April 2012 to November 2014

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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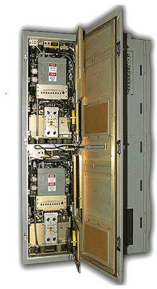
STAKEHOLDER:
PMS 500
PMS 400

TOTAL MANTECH INVESTMENT:
$876,000

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



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:
$5,091,000

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 is to develop an upgrade for the AN/SPY-1 transmitter. This will to enable the Navy to forward- fit and retrofit 72 DDG 51 class 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 is the goal of this effort. The implementation of a solid state switch will provide improved reliability and lower acquisition and life-cycle costs. This will be 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 and 23 Amp pulses to the CFA.

In short, this project's primary development effort is 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 Mean time Time between Between failure Failure (MTBF) while substantially reducing the cost of replacement and maintenance on the AN/SPY-1D transmitter.

Payoff

It is anticipated that the implementation of the SSSA for the SPY-1 radar will result in a cost savings reduction to both the acquisition costs of the High Voltage Modulator (by 70 percent cost reduction) and reduce the life-cycle cost of the Switch Modulator Drawer (by 60 percent cost reduction) while allowing. This approach allows for a significant 4x 4X improvement in reliability over the present tube technology and can be implemented in a relatively short time. The solution will apply to the new build of DDG 51 Flt IIA Destroyers 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 to 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 Class ships. Forward- and back-retrofit totals could potentially reach a total of 72 shipsets, three (3) Land land-based test sites, and spares.

Improving the Yield of SiC High Efficiency Power Switches

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 primarily by transitioning from production on 100mm SiC wafers to 150mm wafers. Several design iterations will also occur under this effort to improve device performance. 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. Conversations with Navy personnel are ongoing 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.

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 the next few years. At that time, CREE will lock down a design with specific power ratings and begin the transition from prototypes to commercial product. To ensure costs are as low as possible, the Navy is interested in CREE driving to a commercial product that the Navy can use in its future designs and upgrades.

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

Ingalls Pursuing Digitally Agile Strategy with 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

S2544 — Machine Readable Material Transactions

Objective

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

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

This is 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 is currently occurring.

Payoff

This technology, once fully implemented, expects to reduce material processing time by 25 percent and reduce annual material losses. These savings account for an estimated $2.75M cost savings per hull. This will provide an increase in accuracy and reduce cycle-time of material transactions; ensure visibility, traceability, and accountability for all material from receipt through delivery to the customer; improve quality inspection and preventive maintenance processes; and reduce the equipment transaction processing time.

Implementation

Upon completion of Phase 1, Ingalls supplied mobile devices to warehousemen, storekeepers, foremen, etc., working the fabrication of DDG hulls as well as current and future programs. The mobile devices are being used as the standard method of material receiving, issuing and tracking. Processes and procedures are currently being updated to support utilization of handheld devices for material tracking based on the feedback. The system was partially implemented in a production environment during the first quarter of FY16.

Ingalls Perfecting Unit Lay-Down Planning with Capacity Planning Automation

S2554 — 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

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 Achieving Digitally Agile Data Strategy

PERIOD OF PERFORMANCE:
June 2014 to August 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:
$402,000

S2555 — Work Flow Tracking System

Objective

Pipe details (PD) are assembled in the Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) Pipe Shop. The duration the pipe detail spends in the Pipe Shop varies from a few days to a few weeks. Prior to this effort, there was a low visibility of the completion status associated to pipe detail within the shop. When the shop foreman commenced work on one pipe detail on the bill, the status of all pipe details became "committed". This delivered an inaccurate view of the completion status for the individual members of the set of pipe details on a bill. Shop foremen spent multiple hours per week manually tracking and generating reports for pipe details committed and completed. The foreman also manually recorded man-hours per employee per pipe detail per shift. This required significant supervisory time and produced imprecise data. Supervisory time spent in record keeping reduced the amount of time spent offering technical assistance and guidance to the shop workers.

The project's primary objective was to develop a modular tracking system and process that allowed for better accuracy of tracking and statusing of individual pipe details while in the pipe shop. A second objective involved collecting labor hour measurements for producing individual pipe details.

The team worked five tasks over the planned 13 month project consisting of developing: (1) a Process Map, (2) Requirements and Functional Systems Design, (3) Automated System Development, (4) Pilot Testing and (5) Final Reporting.

Payoff

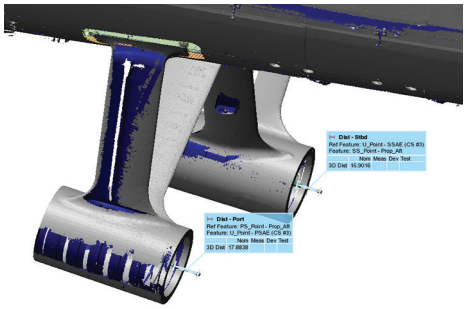
The project improves current processes and equipment Ingalls uses to track the status pipe detail fabrication during shop construction. The technology is expected to improve reporting capabilities for overall throughput of the Pipe Shop, increase the throughput of Pipe Details by four percent, and improve visibility of Pipe Detail Status for planning purposes, equating to an estimated $1.1M annual savings.

Implementation

As a result of this project, an automated process that captures actual time expenditure for 100 percent of all PDs and tracks process steps providing data to validate or improve the established metrics. This technology was vetted during pilot testing and is slated for implementation in early 2016.

Integrated Metrology Approach to Reduce Labor Costs and Schedule for Several Ship Types

S2563 — Integrated Metrology for Ship Construction



Objective

The Navy Metalworking Center (NMC) led a project to develop an integrated metrology approach to address construction alignment issues and reduce associated labor costs and schedule. In shipbuilding, components are manufactured independently and then integrated into larger builds. Considerable labor is required to address alignment issues in large assemblies due to time-lapsed material distortion and variances in stack-up tolerances. Some of the current in-process measurement techniques are underdeveloped, do not allow for design change considerations, and are not tied in with other component evaluations. An integrated metrology approach will collect and assess data as various components and sub-assemblies are fabricated in order to identify misalignment issues prior to final construction phases, thus making corrections easier. The NMC-led Integrated Project Team (IPT)project team optimized advanced metrology solutions to identify misalignment for three scenarios relating to individual component assembly and demonstrated these solutions on the LHA Bolster Casting, DDG 51 Rudder, and DDG 51 Gear Shaft Strut. Additionally, the project team developed an advanced metrology solution to improve alignment for the erection of ship units and demonstrated this solution on DDG 51, LHA, LPD, and NSC ship constructions.

Payoff

The project recommendations will result in reduced rework costs and schedule impacts, as well as improved dimensional and tolerance evaluation on ship construction components and sub-assemblies. The project focused on several naval platforms being fabricated at Huntington Ingalls Industries - Ingalls Shipbuilding, namely DDG 51, LHA, LPD, as well as the Coast Guard's National Security Cutter (NSC). The potential five-year cost savings for the Navy platforms is approximately $4.3M with an additional $500K for the NCS.

Implementation

A digital metrology solution, along with recommendations on how to apply its derived data to shipyard construction and quality processes, will be implemented during the first and second quarters of FY16 on the first available hull in production at Ingalls.

PERIOD OF PERFORMANCE:
November 2013 to July 2015

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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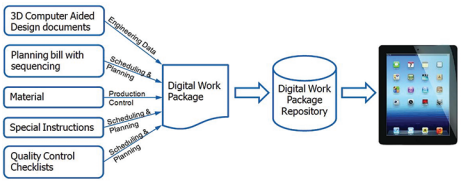
STAKEHOLDER:
PMS 500, PMS 400D

TOTAL MANTECH INVESTMENT:
$1,299,000

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

S2569 — DDG Digital Storyboarding



PERIOD OF PERFORMANCE:
July 2014 to November 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

Objective

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

This project included developing the process and producing a pilot demonstration for providing a digital work package to the craftsmen for construction. The digital storyboard solution will reduce 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 implementation of Digital Work Packages. The Digital Work Package will include product sequence and assembly visualization, manufacturing instructions, material lists, quality control checklists, and any other special instructions or related information and will be 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 should decrease total cycle-time and increase process efficiency. In addition, it will facilitate a rapid response to the engineering change process, reduce the frequency and size of waterfront changes, and provide an improvement in build schedule. This implemented technology is expected to exceed its target to reduce pipe outfitting man-hours by 10 percent from current activities which equates to a cost savings of $3.4M per DDG hull.

Implementation

As the Digital Work Package is 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 completion tasks, a business case analysis is being conducted to document various labor costs including vessel labor time and process improvements. The Ingalls Project Team will obtain approval by both operations and planning for suitable Digital Work Package to be implemented. The results of this ManTech project will be vetted during pilot testing and are slated for implementation in mid-2016 on DDG 117.

DDG 51 Sonar Dome Manufacturing Improvements Implemented Ahead of Schedule

S2579 — Sonar Dome Fabrication Process Improvements

Objective

This Navy Metalworking Center (NMC) project is streamlining the processes and procedures used to fabricate the Aegis Destroyer (DDG 51 class) sonar dome, which has a complex geometry and is challenging to construct. NMC is investigating metrology solutions as well as customized fabrication tools, fixtures, and automation / mechanization, 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).

Payoff

This project is expected to reduce the labor required to fit and assemble DDG sonar dome components and structures across several process areas (28,000 labor-hours). The estimated labor reductions will save $15M over five years on platforms constructed at Ingalls. The project's process improvements also may improve environmental, health and safety conditions for employees.

Implementation

Due to successful demonstration and tool validation, Ingalls has implemented two material removal tools (the Equipois zeroG4® mechanical arm with NMC-developed magnetic mounts and the Hypertherm® Powermax® 105 plasma cutting and gouging system) earlier than anticipated, in the first quarter of FY15, for DDG 117 and 119. Ingalls is buying additional Powermax 105 units for use on sonar domes and other key fabrication areas. Ingalls is planning to purchase additional mechanical arms for use throughout the shipyard. In addition, these solutions will be applied to Amphibious Assault Ship (LHA), Amphibious Transport Dock (LPD) and National Security Cutter (NSC) hulls under construction at Ingalls, saving approximately 12,000 additional labor-hours

PERIOD OF PERFORMANCE:
October 2013 to February 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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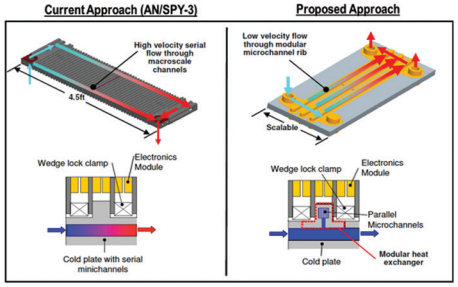
STAKEHOLDER:
PMS 400D
PMS 500
PEO (Ships)

TOTAL MANTECH INVESTMENT:
$2,139,000

New Manufacturing Approach for Cold Plates Will Provide Cost and Performance Benefits



PERIOD OF PERFORMANCE:
April 2014 to February 2016

PLATFORM:
DDG 51 / DDG 1002

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500
PEO IWS 2.0

TOTAL MANTECH INVESTMENT:
$1,182,000

S2590 — Modular Scalable Cold Plates for Naval Electronics

Objective

This Navy Metalworking Center project is developing a modular, high-performance and scalable approach to manufacture naval cold plates based upon a prototype system designed and developed by Raytheon. The project specifically focuses on friction stir welding (FSW) process development to fabricate the scalable cold plate assemblies, the design of fixtures necessary to achieve the manufacturing geometries required, and the demonstration and characterization of a full-scale prototype of the cold plate system.

Payoff

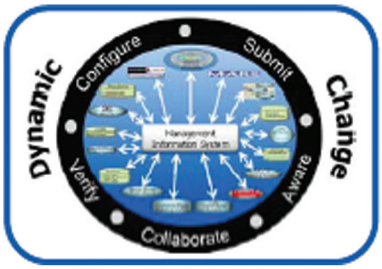
Using FSW to assemble these modules offers considerable benefits over conventional joining technologies, including lower distortion and improved weld strength and quality, and is anticipated to reduce cold plate acquisition costs by approximately 40 percent. The total potential cost savings for DDG 1002 and the AMDR component on five DDG 51 Flight III hulls would be $1.9M. In addition, the size and relative simplicity of the modular heat exchangers will increase the number of vendors with equipment and personnel capable of manufacturing naval cold plates.

Implementation

The hardware developed in this project is anticipated for use on the AN/SPY-3 X-Band Radar component on DDG 1002 in FY18. The technology might also be applicable for use in the "Enterprise X-Band Illuminator" on DDG Flight III in FY18. Pending successful demonstrations, the cold plate technology also might be incorporated into additional radar systems. The overall radar system is expected to be implemented once it is installed by the weapon systems' supplier.

Ingalls Pursuing a Real-Time Production Change Awareness Process

S2594 — Dynamic Change Awareness



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.

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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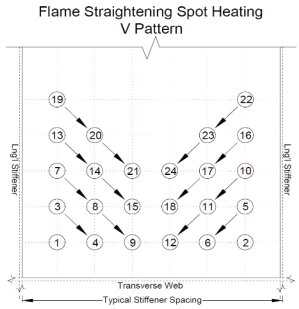
STAKEHOLDER:
PMS 500
PMS 400

TOTAL MANTECH INVESTMENT:
$1,661,000

Structural Fairing Process Improvements Reduce Distortion and Re-work Costs



PERIOD OF PERFORMANCE:
July 2014 to February 2015

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 500
PEO (Ships)

TOTAL MANTECH INVESTMENT:
$151,000

M2598 — Structural Fairing Process Improvement

Objective

Thermal and mechanical straightening are the current processes used to correct distortion in shipbuilding. Although effective, these processes are largely trial and error-based with vague operational guidance available. The lack of specific guidance on processes leads to several negative effects, such as significant structural damage, costly rework, process delays, and unknown quantities of residual stress in structural members. Instances of crippled structures due to overheating distorted thin material have not only caused increased rework but has also instilled engineering concerns about these levels of unknown stress buildups caused by the current process.

This project isolated key factors causing process delays, structural damage, and cost overruns that the team evaluated and improved. The improvements led to revised procedures and improved personnel training. The new procedures are expected to reduce flame straightening process time by up to 75 percent and bring consistency and repeatability, addressing ineffective legacy processes

Payoff

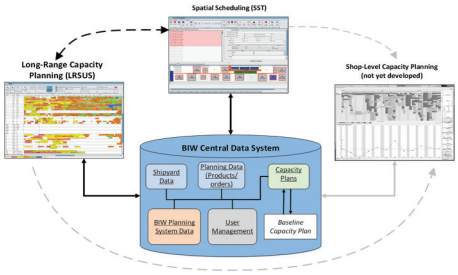
The flame straightening labor cost savings associated with this project are estimated strictly based on the process time improvement. While difficult to quantify due to the nature of how rework bills are processed, savings on compartment completion and paint rework resulting from flame straightening process improvements are anticipated. Projected savings are $453K per DDG 51 hull.

Implementation

Due to the effectiveness of the new procedures, some supervisors began instructing operators to use the new procedure prior to project completion. The Hull Director was periodically briefed throughout the project and agreed to train all flame straighteners upon project completion. The handbooks have been printed and are available to all straighteners and supervisors for training and will accompany straightening personnel with the other tools needed for the job.

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 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 $741K/hull, resulting in a one-year ROI of 6.37:1

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

Implementation

Prototype versions of the Long-Range and Shop-Level Capacity Planning and integrated Spatial Scheduling tools were demonstrated and transitioned to BIW planning department incrementally during Phase 1 of this project. These demonstrations included members from the user community and planning department management. Several iterations of the software were delivered and tested by the BIW user group and are beginning to be transitioned into the planning process workflow. Phase 2 will continue to develop the tools focusing on the development and transition of the Shop-Level Capacity Planning Tool. It is expected that the system will be fully transitioned by July 2016.

PERIOD OF PERFORMANCE:
July 2014 to July 2016

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:
$600,000

Improvements in Ship Stiffener Manufacturing to Reduce Shipbuilding Labor Costs

PERIOD OF PERFORMANCE:
July 2014 to July 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) is leading 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) is characterizing the current causes of inaccuracies and inconsistent quality of these fabricated stiffeners; developing process improvements; and developing tooling and prototype equipment to improve the stiffener manufacturing process.

Payoff

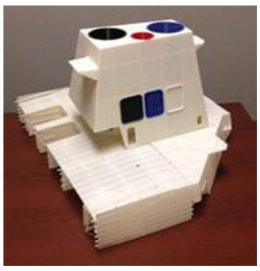
The project's solutions will reduce labor and rework and increase accuracy and throughput, significantly lowering costs and improving the production schedule for this operation. The automated technologies used to cut and weld the stiffeners will be implemented at Ingalls Shipbuilding (Ingalls) and are expected to save $6.1M in labor savings alone during a five-year period across several platforms in labor savings alone.

Implementation

The IPT will develop prototype systems and tooling that will be tested for functionality and efficiency at the Ingalls stiffener fabrication area. Upon successful completion of 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 fourth quarter of FY16.

ManTech Project to Demonstrate Additive Manufacturing Benefits for Ship Construction

S2608 — Additive Manufacturing for Shipbuilding Applications



Objective

Additive Manufacturing (AM) is rapidly becoming a versatile tool in the manufacturing industry as the cost of acquiring and implementing the technology decreases. Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls) and General Dynamics Electric Boat (GDEB) are interested in using AM for several potential applications, such as visual aids for manufacturing, planning and staging as well as production aids for temporary construction and templates. The Navy Metalworking Center (NMC) is conducting a project that will demonstrate the cost and time benefits of AM to support the construction of Navy platforms. For Ingalls, the Integrated Project Team (IPT) will assess and demonstrate the use of AM during ship construction activities, quantify the expected benefits, and provide a recommended path toward implementation. For GDEB, the IPT will develop and demonstrate a process map that will allow the rapid production of tools and fixtures using AM. Using AM for these applications will lead to cost and time reductions, as well as improvements to first-time quality during ship construction.

Payoff

Ingalls has estimated a minimum acquisition cost savings of $800,000 per year by utilizing AM for the construction of DDG, LHA, and LPD. GDEB has estimated a minimum acquisition cost savings of $200,000 per VIRGINIA Class submarine (VCS) by using AM technology to rapidly deploy new tooling and fixtures.

Implementation

On-site testing at Ingalls of AM printed parts will be used to develop an implementation plan and to support a business case to invest capital funds for the purchase of a 3-D printer. At GDEB, the project-validated process map will be used as the basis for a procedure to instruct shipyard personnel on how to rapidly deploy new tooling / fixtures using AM. Implementation at Ingalls is planned in FY17 for DDG 121, LHA, and all future surface combatants produced there. Implementation at GDEB is planned to occur in FY 17 on VCS (SSN 794).

PERIOD OF PERFORMANCE:
October 2014 to June 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 400D
PMS 377, PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$1,300,000

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

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 400D

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 $1.7M across all platforms constructed at Ingalls, i.e., DDG 51, LHA, LPD, and NSC.

Implementation

The Integrated Project Team (IPT) will evaluate current processes to identify part families and associated processes to target for automation / mechanization. NMC and Ingalls will establish prototype work cell requirements that will be used to develop automated work cell concepts for the highest priority and ranking part families. NMC will work with Ingalls to design flexible fixtures that accommodate the variation of geometries between platforms and part families that are produced in the work cell. The concepts will be down-selected and developed to demonstrate the manufacturing cell benefits. 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

PERIOD OF PERFORMANCE:
May 2015 to November 2016

PLATFORM:
DDG 51

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
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TOTAL MANTECH INVESTMENT:
$1,300,000

Objective

The traditional manual welding processes used to fabricate innerbottoms and other large structures are time-consuming and can be ergonomically challenging. This Navy Metalworking Center (NMC) project is developing an automated approach to weld DDG 51 complex assemblies using existing robotic welding systems as a foundation. The project is investigating several robot-mounted measuring systems for suitability for this application. The project also 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 orientate the welding head, and execute a suitable multi-pass weld.

Payoff

Large-scale implementation of robotic welding at the peripheral vertical launch system (PVLS) cell is estimated to produce $5.6M savings for the DDG 51 Class at General Dynamics Bath Iron Works (BIW) over five years as a result of labor and material savings and schedule compression. The life-of-program savings for DDG 51 as a result of this implementation are estimated to be $17.8M based on 16 ships constructed at BIW.

Implementation

Large-scale production implementation of this project will take place at BIW in the existing facility that currently houses the robotic weld cell for PVLS welding fabrication. The current robotic welding system 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 use of a production component is approved for validation in the large-scale trials, then the large-scale trials will be considered the implementation point, provided the trials are successful. If a mockup structure is used for the large-scale trials, then implementation will occur on the first production unit after completion of the trials which is estimated as the second quarter of FY17 on DDG 120. Implementation at that site will be limited to three innerbottom units due to space constraints. Implementation will take place at the PVLS cell in the Aluminum Shop at BIW.

LCS Projects

S2410 — Low-Cost Open Architecture Radar (LCOR) 52
S2455 — Light-Weight Low-Cost SeaRam 11-Round Guide Phase 1 & Phase 2 53
S2523 — Degaussing System Manufacturing Improvements 54
S2558 — Manufacturing Cost Reduction for LCS Scalable Electronic Warfare (EW) System 55
S2603 — Reverse-Brayton Cryocooler Manufacturing Improvements 56

Low-Cost Open Architecture Radar Meets Navy's Upgradable Systems Requirement

PERIOD OF PERFORMANCE:
February 2011 to September 2015

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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TOTAL MANTECH INVESTMENT:
$11,000,000

S2410 — Low-Cost Open Architecture Radar (LCOR)

Objective

The current Littoral Combat Ship (LCS) radar system solutions have posed various challenges to the U.S. Navy. Both LCS currently use foreign-built and –supported Volume Search Radars (VSR). Lockheed Martin (LM) uses the EADS TRS-3D radar and Austal uses the Saab Sea Giraffe radar. These solutions do not provide the technical data the Navy requires for performance and radar system modeling, vital for a new surface combatant platform. Also, these current systems have not met the desired affordability objectives.

The initial intent of this project was to provide the Navy with an open-architecture radar that would meet the Navy's current LCS requirement for a low-cost, upgradeable system. Directed sources for both a custom-designed solution and a COTS solution were investigated. This ManTech effort has developed the following technologies, using the Thales–designed, Exelis-produced and -supported AN/SPS-76 radar as a proof-of-concept basis: (1) an Intelligent Technical Data Package (ITDP), with full Government Purpose Data Rights, (2) modular, COTS-based RF packaging at the component level, which will ensure rapid upgradability in reaction to emerging technology or threats, and (3) Hardware-in-the-Loop simulation of the radar system and its environment, as well as the expected threats it will have to counter. The capabilities developed on this project provide the Navy with the capability to rapidly react to emerging threats and/or incorporate new technologies, precluding the need for complete system replacement or lengthy and costly major design upgrades. This project was a joint project with cost share from OSD ManTech.

Payoff

This project will ensure the cost reduction of the current LCS radar system by approximately 20 percent through open competition for a GFE radar solution which will fit into the existing radar's top side and below decks available footprint. The results of this effort may be applied for use on the Navy's Small Surface Combatant program as well as the USCG Offshore Patrol Cutter program. It could also be considered as a replacement for the AN/SPN-43 radar on large-deck amphibious platforms and carriers for associated impact and cost savings.

The competition is expected to yield a radar system which fully meets the LCS mission requirements at an acquisition savings of ~ $1M per hull.

Implementation

The ManTech transition event will occur with the inclusion of the requirements for an Intelligent Technical Data Package with full Government Purpose Data Rights, Modular COTS-based RF Packaging, and Hardware-in-the-Loop simulation capability in a solicitation under the authority of IWS-2 for open competition for a GFE radar for the LCS and future small surface combatants.

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

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.

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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TOTAL MANTECH INVESTMENT:
$4,000,000

Manufacturability Improvements to Avoid Production Costs of Degaussing System on Future Combatants

PERIOD OF PERFORMANCE:
January 2013 to November 2014

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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TOTAL MANTECH INVESTMENT:
$1,730,000

S2523 — Degaussing System Manufacturing Improvements

Objective

The implementation of a High Temperature Superconducting Degaussing (HTSDG) system on a future surface combatant is currently in progress under the leadership of the Naval Ship Systems Engineering Station. The objective of this Navy Metalworking Center (NMC) project was to improve the manufacturability of this system in two key areas to enable near-term implementation for future Navy platforms. The first focus area involved the development of a soldering process for an efficient, robust, repeatable solder joint connection between an HTS wire and copper pin where joint visibility is restricted and minimal heat must be used. The second focus area consisted of defining and demonstrating a manufacturing process to bundle the HTS wire that doesn't damage the wires or wire insulation. The Integrated Project Team (IPT) developed and validated a customized induction heating system to solder critical joints that met all physical and functional requirements. The IPT also developed a process to bundle the uniquely shaped HTS wire that does not impart mechanical damage to any of the individual wires or impair the insulation on those wires.

Payoff

AMSC, the HTSDG system provider, estimated $651K per LCS in cost avoidance with the implementation of manufacturing solutions on a full HTSDG shipset order from the Navy. Additional benefits include increased HTSDG system reliability, reduced lead time, which mitigates schedule risk to the Navy, and increased HTSDG cable capacity.

Implementation

The complete, validated soldering system and bundling line have been transferred to AMSC for production use. Implementation is planned on future surface combatants as HTS degaussing system implementation is approved by the Navy.

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 (SEWIP) Block 2 will result in a cost- saving scaled EW system solution (SEWIP Lite). 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 LCS 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 Block 2 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 MMIC technologies in the millimeter wave downconverter, tuner technology, new filter substrates, new RF fiber optic design, automated test processes, common chassis and a replacement common processor system.

Payoff

SEWIP Lite will provide a variant- independent EW system that meets LCS mission requirements and performance objectives, as well as improving improves the capability offered by current systems. SEWIP Block 2 will also benefit for 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 SEWIP, 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 SEWIP Lite 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 $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 SEWIP Block 2 and SEWIP Lite through the Program of Record acquisition change process. The SEWIP Lite production representative system completed assembly and formal qualification testing in 2014, and was provided for customer evaluation on LCS 1 in third quarter FY14. It successfully completed at- sea testing in fourth quarter 2014 and first quarter 2015. SEWIP Lite Low Rate Initial Production (LRIP) tentatively scheduled for third quarter FY15 release will contain the TDP updates with the approved ManTech affordability improvements. With regards to the overall SEWIP Block 2 Program, there is a scheduled FRP for Block 2 third quarter FY15 and second quarter FY16. Quantity 38 LRIPs for Block 2 have already been contracted to Lockheed Martin MST. Two of the ManTech affordability improvements have been approved for incorporation into the SEWIP Block 2 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 SEWIP Block 2 LRIP and FRP procurements. The USCG Offshore Patrol Cutter and Fast Frigate are planned and scheduled to be part of the SEWIP Lite FRP.

PERIOD OF PERFORMANCE:
March 2014 to January 2016

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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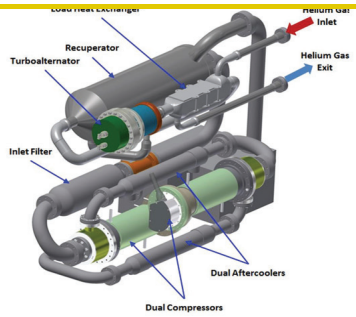
TOTAL MANTECH INVESTMENT:
$4,197,000

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



PERIOD OF PERFORMANCE:
July 2014 to February 2017

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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TOTAL MANTECH INVESTMENT:
$1,477,000

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 production costs. This Navy Metalworking Center (NMC) project will identify and demonstrate production cost savings for parts within the primary components that make up the cryocooler – the turboalternator, the compressor, and the recuperative heat exchanger. NMC will identify manufacturing alternatives, and the Integrated Project Team (IPT) will evaluate them through bench-top trials where possible. Manufacturing industry representatives will fabricate prototypes of down-selected parts to demonstrate proof of concept and to ensure that the form, fit, and function of these items are not adversely affected as a result of project recommendations. Improving the manufacturability and reducing the production cost of the cryocooler will provide significant cost avoidance and make HTS degaussing systems more attractive for both near-term and future naval implementation.

Payoff

The project's goal is to achieve a cryocooler purchase price of no more than $200K per unit based on a 16-unit purchase; success will result in a $7M savings over five years if implemented on future ship classes.

Implementation

NMC will create documentation packages that outline specific manufacturing improvements necessary to reduce the fabrication costs of three major cryocooler components. Creare will incorporate these manufacturing improvements to develop and fabricate a production cryocooler unit that can be used to conduct qualification testing and shipboard demonstration. Implementation is expected to occur on a future surface combatant, pending successful qualification of the complete reverse-Brayton cryocooler.

VCS/OR Submarines Projects

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Automating Cable Testing Results in a $468K per Hull Cost Reduction

PERIOD OF PERFORMANCE:
June 2010 to June 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
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TOTAL MANTECH INVESTMENT:
$1,960,000

S2306 — Integrated Link Testing

Objective

Manual pin-by-pin measurement of thousands of electrical and fiber optic links is time-consuming and error-prone. Uncertainties and omissions in each data record must be corrected before final data submission and approval. For the VIRGINIA Class submarine (VCS) platform, typical cable test time is 36,000 hours per hull. Associated with the manual certification process is risk with hook-up errors and data transcription errors. The objective for this project was to significantly reduce the errors encountered in cable testing by (1) automating repetitive measurements and (2) automating the data upload process with the Integrated Link Test System (ILTS).

Payoff

A significant reduction in the amount of labor involved in measurement and certification of the cabling used in the VCS platform is a major benefit resulting from this project Another benefit is improved affordability by using automation to increase the efficiency and accuracy of test data collection. Project metrics relate to: (1) collection of cable link requirements leading to acceptance criteria, (2) definition of test system requirements (presently over 500), and (3) test time per pin / link. ILTS is linked to a shipyard database, and deck access time is reduced because data can be manipulated from anywhere.

The total projected cost savings for VCS is $468K per hull. An incentive toward further cost benefit is through further standardization of connector types. Reducing the number of connector types reduces cabling inventory, spares, test fixtures, and ultimately reduces life-cycle cost through simplification of maintenance procedures.

Implementation

The first implementation is occurring aboard the VCS platform. The ILTS has a modular design that can be adapted for other test functions and platforms. Once the system is demonstrated on representative hardware, it will be established that the system, in general, will successfully operate in the VCS and be suited for general shipyard use. Further implementation (i.e., use of the Integrated Link Test System on other applications and platforms) then will only require specific fixturing for that particular platform. An ecosystem has been organized around fixturing, platform specific modifications, and general system functions.

The event that defines transition is demonstration of ILTS use in its first application within VCS production. This event will signify that the general system is ready for use in manufacturing systems and for further implementation on other platforms. For VCS, implementation is expected to begin in late 2015 at the Huntington Ingalls Industries - Newport News Shipyard.

Automating Rotor and Stator Dimensional Verification Tasks Supports VCS Build Rate and Improves Production Efficiency

S2401-2 — Measurement Technology Systems Phase 2

Objective

The Naval Foundry and Propeller Center (NFPC) provides the Navy with submarine propellers. As an integral part of the manufacturing process, one of the many quality actions conducted by NFPC Quality Assurance is the inspection of castings for dimensional accuracy, surface defects, and machining irregularities typically performed during all phases of foundry and propeller manufacturing operations. The legacy laser measurement system in place is a large, complex, stationary system measurement machine that is difficult to maintain and frequently out of service. The Measurement Technology System project was a design / build effort focused on developing an automated / semi-automated inspection system for VIRGINIA Class submarine (VCS) rotors and stators. The project team successfully designed, developed, fabricated, assembled, installed, and tested an automated / semi-automated inspection system for VCS rotors and stators.

Payoff

This technology can potentially save an estimated $200K per hull and support the two VCS/year build rate. These savings will result from the utilization of robot technology to improve quality and reduce dimensional verification workload

Implementation

This technology has been implemented at the Navy Foundry and Propeller Center, Philadelphia, PA.

PERIOD OF PERFORMANCE:
March 2013 to May 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication
Automated Tools

CENTER OF EXCELLENCE:
NSAM

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TOTAL MANTECH INVESTMENT:
$649,000

Addition of Insulating Coatings to Retractable Bow Plane Cylinder Rods for Improving Seal Life and Increasing Lifetimes

PERIOD OF PERFORMANCE:
January 2013 to September 2015 (iMAST)
July 2013 to July 2015 (NSAM)

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication Coatings

CENTER OF EXCELLENCE:
iMAST and NSAM

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TOTAL MANTECH INVESTMENT:
$813,000 (iMAST)
$345,000 (NSAM)

S2449 — VCS Retractable Bow Planes System Improvements

Objective

The retractable bow plane extend / retract hydraulic cylinders and seals on VIRGINIA Class Submarines (VCS) are experiencing premature failure. These failures are attributed to the build-up of calcareous deposits on the Monel® K-500 bars used in the fabrication of these components. Subject rods are placed in a cathodic protection system and are susceptible to the formation of calcareous deposits since no protective coatings are applied to them. When the seals fail, an unplanned dry-docking or cofferdam is required to replace the seal. Current experience shows the seals are failing on average of once every 12 months. The original seal life was designed to correspond within 72 month Extended Dry-docking Selected Restricted Availability (EDSRA) schedules. With EDSRA schedules expected to be extended to 96 months, a means to increase the seal lifetime is needed.

The objective of this project was to optimize a thermal spray coating solution for extend / retract cylinder rods in the VCS retractable bow plane system. The coating had to be robust enough to adhere to the Monel® K-500 rod with no cracking taking place over the prescribed month between major maintenance events or overhaul.

Payoff

The primary payoff is cost avoidance by reducing unscheduled maintenance events thereby complying with the planned maintenance periodicity extension from 72 to 96 months. Analysis of cost savings expected in concert with the addition of the insulating coating to extend / retract cylinder rod was completed by General Dynamics Electric Boat (GDEB). A cost savings of approximately $9.6M over the life of each submarine is expected. This cost savings estimate is based on the savings of nearly 29 seal system replacements over the life of each submarine; that details out to a cost of $330K per seal. Total life cycle cost savings on the VCS is just under $300M.

Implementation

This project was divided into two primary phases. The first phase covered the optimization of the thermal spray coating. In this phase, the adhesion strength of the coating was increased by more than 50 percent, and it has undergone testing on a full-scale test stand at GDEB for more than 4000 cycles of service. The coating exceeded the required adhesion strength and performance levels developed by the Institute for Manufacturing and Sustainment Technologies (iMAST) and defined by GDEB. NAVSEA has given its approval for implementation and the project has proceeded to vendor qualification.

A vendor has been identified and has completed work defined in the qualification test plan. Once the vendor passes this qualification test, NAVSEA's approval will be given and the implementation process will be completed. The project has been transitioned to GDEB for implementation and production of assets for installation on Block IV VCS as part of their new construction.

NOTE: This project was led by the Institute for Manufacturing and Sustainment Technologies (iMAST) with a portion of the work performed by the Naval Shipbuilding and Advanced Manufacturing (NSAM) Center.

Robotic Manufacturing Technologies for VCS Interim Products to Reduce Production Costs

S2459 — Robotic Welding of VCS Interim Products

Objective

Operations personnel involved with the production of VIRGINIA Class submarine (VCS) structural fabrications identified structural welding as a major contributor to construction costs. Major fabricated structural assemblies have been broken down by product structure and defined as either "part family" (PF), "interim product" (IP), or "major product" (MA) assemblies. The objective of this project was to reduce welding costs for part family and interim product and major product assemblies by increasing the number of joints that can be welded using robotics.

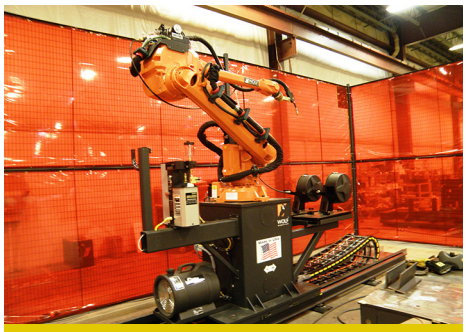
Phase 1 was successfully executed with the procurement of the robotic welding cell and initial weld process development for PF/IP assemblies. Completed second phase activities were PF/IP welding process development, robot installation at General Dynamics Electric Boat (GDEB) Quonset Point (QP) and development of the roadmap to implement robotic manufacturing at GDEB QP. In Phase 2, GDEB identified alternative methods and equipment, evaluated the prototypes from the down-selection of options, created a detailed implementation plan (with business case) for the selected methods, provided data needed to support welding qualifications, and trained GDEB personnel to program and weld with the robotic cell.

Payoff

This technology could potentially save an estimated $1.2M per hull. These savings will result from enabling discrete planning of welding small assemblies within existing planning systems and increasing the percent of first time quality. While the project focuses specifically on improvements benefiting the VCS, the same benefits described here can accrue to all U.S. Naval ships.

Implementation

GDEB will implement robotic welding of Interim Product assemblies at the Quonset Point facility. The shipyard evaluations have shown savings for both the fitting and welding times greater than the 30 percent estimated at the onset of this task. The first article assemblies have proven the capability for a fully outfitted robotic welding cell to reduce the fitting and welding cost of interim product assemblies. Welders have been trained, passed their qualification tests, and are ready to start robotic welding. The results of this ManTech project are scheduled for implementation in production of VCS hulls in the fourth quarter FY15.



PERIOD OF PERFORMANCE:
July 2012 to August 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication
Automated Tools

CENTER OF EXCELLENCE:
NSAM

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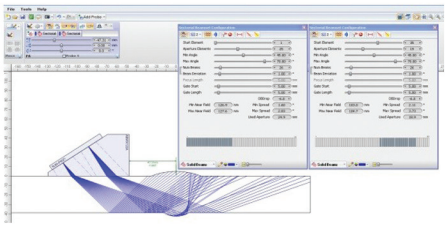
TOTAL MANTECH INVESTMENT:
$2,067,000

Advanced Ultrasonic Inspection to Reduce VCS Construction Costs



PERIOD OF PERFORMANCE:
April 2013 to February 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
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TOTAL MANTECH INVESTMENT:
$1,022,000

S2499 — Advanced UT Methods of NDT of Hull Welds

Objective

Historically, Radiography Technique (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 Technique (UT)) as a negative contributor to construction costs. The goal of this project is to achieve a 20 percent reduction in 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 Radiography Technique (RT) and conventional Ultrasonic Technique (UT).

The project will be 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, currently underway, is comparing the effectiveness of conventional UT versus PAUT inspections on as-welded VCS hull butt welds at General Dynamics Electric Boat (GDEB) Quonset Point. The main focus of this project is 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

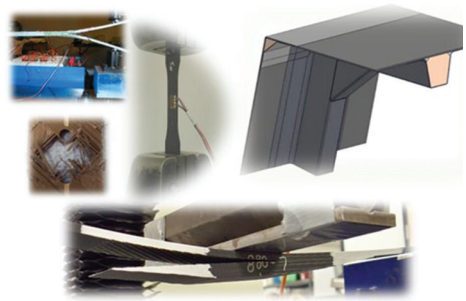
This technology could potentially save an estimated $541K per hull. These savings will result from less surface preparation or grinding of weld reinforcement, the potential for automation thereby increasing inspection speeds, and the potential for reducing the need for radiography and the risks associated with ionizing radiation. While the project focuses specifically on improvements benefiting the VCS, the same benefits described here can accrue to all U.S. Naval ships.

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 third quarter FY16. However, the schedule for implementation activities is dependent on project results.

Pushing the Edge of Next Generation Composite Technologies for Submarines

Q2522 — Carbon/Epoxy Out of Autoclave (OOA) Scalability



Objective

Out-of-Autoclave (OOA) prepregs are conventionally utilized for applications requiring laminate thicknesses less than 0.25 inches. Scaling to thicknesses in excess of 0.25" on parts with large surface areas has caused manufacturing defects which can lead to a reduction in mechanical performance. The objective of this project was to demonstrate and validate repeatable manufacturing processes that result in desired mechanical properties at a large scale level for submarine system component.

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

One payoff for this project is the demonstration of technologies that can be leveraged onto future and previously developed composite articles on the VIRGINIA Class and other submarines. These technologies will reduce cost, weight, and manufacturing time to varying degrees depending on which are implemented on the articles. Return on investment will be developed for point insertions as they are considered.

Implementation

This project proposed a tiered approach to define and mitigate issues associated with scaling OOA materials systems to thick, large surface area components typically associated with undersea combatants. Coupon-level testing was used to baseline structural properties, followed by intermediate-sized part fabrication and testing activities to demonstrate interim-level scalability and property translation to reduce risk associated with larger-scale prototypes. A representative large-scale component will be defined and fabricated / tested to validate prior sub-scale efforts. This project culminated in a final demonstration representative of large structural panels in consideration for VCS applications.

PERIOD OF PERFORMANCE:
August 2013 to September 2015

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:
$748,000

Development of Fire Safe Resins for Submarine Applications

PERIOD OF PERFORMANCE:
November 2013 to December 2015

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:
$519,000

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 approaches result 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 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 allowables. 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.

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

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. Implementation will occur at General Dynamics Electric Boat (GDEB) with an anticipated date of 2018 on SSN 793. 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.

Durability Coating Improves Life of VIRGINIA and SEAWOLF GTC Tile

S2541 — GTC Durability Coating

Objective

The gradual transition coating (GTC) applied to SONAR Baffle Tiles installed on SEAWOLF and VIRGINIA Class submarines (VCS) have experienced issues with cracking and delaminating while in service. During a recent Extended Drydocking Selected Restricted Availability (EDSRA), several GTC tiles required replacement due to cracks and delamination. Applying a durability coating to the tile edges will eliminate these issues and ensure that the tile lasts throughout the life of the ship. The Navy Metalworking Center (NMC) Integrated Project Team (IPT) 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.

Payoff

Applying the durability coating on the GTC tile using materials and process parameters developed during this project will result in a potential net $600K per hull cost savings for in-service VCS, resulting in a $3.0M cost savings over five years. The project also will reduce the total ownership cost of future VCS hulls by $600K per hull. Assuming 10 hulls will be built in the next five years, the total ownership cost for the new construction hulls will be reduced by $6.0M. The results of this project also could avoid $4.4M in repairs on SEAWOLF Class submarines. The overall cost benefits for in-service VCS and SEAWOLF and new construction VCS could total $13.4M.

Implementation

Once PMS 392 and PMS 450 accept the project recommendations, implementation will occur in two ways. First, either shipyard personnel or a contractor will apply the recommended coating developed during the project after shipyard personnel inspect the tile on in-service hulls during EDSRA, which will initially occur at Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility. The first application is expected to occur in 2016. The second implementation also will occur in 2016 for new VCS construction. It is expected that application of the durability coating will occur at the GTC tile manufacturer after a procurement specification change is completed by General Dynamics Electric Boat. The construction shipyard will receive the tile with coating in place; therefore, no impact on construction activities should occur. The implementing organizations will revise drawings and procedures that define the addition of the durability coating.

PERIOD OF PERFORMANCE:
May 2013 to September 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

Repair of VLS Tubes is Accelerated Through Improvements to Laser Clad Repair System

PERIOD OF PERFORMANCE:
July 2013 to September 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 450
PMS 392

TOTAL INVESTMENT:
$398,000

S2545 — VLS-LCRS Updates for Production Readiness

Objective

Corrosion and pitting around the counter-bore sealing surfaces of Vertical Launch System (VLS) tubes have been repaired traditionally by labor-intensive manual brush electroplating. These repairs are relatively short-lived and require frequent rework. A prototype mechanized Laser Cladding Repair System (LCRS) was demonstrated at Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility (PHNSY) in 2010 on the USS Chicago with mixed reviews. The repairs were much better than traditional plating, but the lack of sufficient spare parts and a concern for the lack of a back-up system produced a concern for the system's "production readiness." This project updated the system's production readiness by reducing risks associated with usage.

This risk reduction project was funded through the Navy ManTech program as well as through the Naval Undersea Warfare Center, Keyport (NUWC-DIV KPT) and PHNSY. The ManTech project objectives included assessed improvements to 1) system reliability, and 2) overall system repair time of the VLS-LCRS tool upon failure of individual system components. For example, a new optical fiber reel was developed to facilitate ease of use, protection of the fiber during storage, and support the quick replacement of the fiber upon failure/damage.

Payoff

To compare traditional electroplating repairs of VLS tubes to similar repairs using the VLS-LCRS, a cost benefits analysis was conducted by NUWC-DIV KPT in April 2012 using data compiled from PHNSY VLS Value Stream Analysis (VSA) 9/09. This analysis included the Pacific Fleet 688 Class submarines (higher incidence of corrosion damage), thus yielding conservative values in consideration of tubes on the entire Navy fleet of submarines. The analysis did not consider cost savings from HAZMAT reduction, thus making the estimated ROI even more conservative.

The cost avoidance was estimated at $6.2M over 10 years with a conservative return on investment (ROI) of 4.9. Laser cladding repairs are expected to be more durable than brush electroplating repairs and last up to 10 years. The number of tubes needing repair was estimated to be 12 tubes per major overhaul (one per sub every six years) and four tubes per moderate overhaul (one per sub every year), resulting in approximately 75 tubes per year (45 percent of the PAC Fleet 688-Class VLS tubes per year). NUWC-DIV KPT's cost benefits analysis reduced this estimate to 1/3 of the noted tubes for an even more conservative approach.

Implementation

All VLS-LCRS equipment and project deliverables were transferred to PHSNY, and implementation occurred on the USS Asheville in December 2014. Moreover, PHNSY continues to endorse usage of the VLS-LCRS, as it is currently deployed on the USS Jefferson City (June– November 2015) for the repair of her VLS tubes. PHNSY is actively seeking additional boats for future implementation.

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 third quarter FY16.

PERIOD OF PERFORMANCE:
December 2014 to March 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:
$640,000

Innovative Machining Techniques to Reduce Costs for VCS Propulsor Manufacturing

S2548 — Machining Alloy 625 Propulsor Components

PERIOD OF PERFORMANCE:
July 2013 to April 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,326,000

Objective

In an effort to reduce the total ownership cost of VIRGINIA class Class submarines (VCS), the Navy will change the propulsor material on Block IV hulls to Alloy 625, a nickel-based alloy that is highly corrosion resistant, but very difficult to machine. To mitigate the anticipated cost and schedule impact, the Navy Metalworking Center (NMC) led an Integrated Project Team (IPT) to address the manufacturing challenges associated with machining these components. Specifically, the IPT investigated innovative machine tooling, alternative cooling technologies, and other machining process improvements. NMC developed small-scale test articles and a protocol that replicated the major regimes (weld cap removal, roughing, and finishing) encountered during production, and then performed an extensive test matrix to identify the optimal cutting insert and process parameters. The optimized tools and machining parameters demonstrated effective material removal rates of two to three times those of the baseline processes, taking into account each tool life and tool change time. The project also investigated internal threading of Alloy 625 and demonstrated power tapping as a viable method, along with the potential cost and quality improvements.

Payoff

This project will improve the production rate and reduce the cost increase anticipated for the production of Alloy 625 propulsors. Original estimates to machine Alloy 625 are roughly three times the cost and duration of the present propulsor machined from HY steel. By implementing a more aggressive machining process, the project is expected to save at least $6M over a five-year period. Internal threading with power tapping is estimated to save an additional $129K per hull through cost reduction and avoidance of rework. By reducing the duration of this critical path process by an estimated 150 days, the project has substantially reduced the risk of late components which would have delayed ship delivery and incurred program costs estimated at $85K per day.

Implementation

Project implementation was originally targeted for VCS Block IV propulsor production. However, in April 2015, BAE Systems began early implementation on Alloy 625 sections of Block III propulsor components and will continue to work through production environment challenges. Internal threading of Alloy 625 will commence with Block IV production.

Trade-Friendly Locating Dimensional Technologies Can Improve Productivity

S2550-A-B —Trade Friendly Locating Dimensional Techniques

PERIOD OF PERFORMANCE:
May 2014 to February 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)

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 is 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 is divided into two distinct phases, executed similarly to other standard process improvement efforts. The project team will focus 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 have demonstrated through execution of an Evaluation Test plan that they are capable and viable for prototype testing. One system is being prototyped in Phase 2, currently underway. This system was the top pick for 'trade friendliness' and earned the highest score during the technology evaluations. Phase 2 is 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 is the VCS Program, it also offers opportunities to improve manufacturing processes for the Ohio Replacement (OR) Program.

Payoff

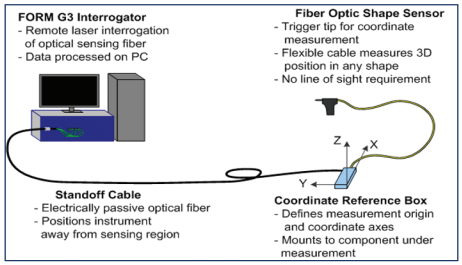
This technology, once implemented, could potentially save an estimated $860K per VCS hull and OR hull. These savings will result from replacing or enhancing common mechanical measurement tooling.

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 second quarter FY16. 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).

Novel Non-Line of Sight Dimensional Metrology for Shipbuilder Applications: Fiber Optic Measurement and Shape Sensing



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

PERIOD OF PERFORMANCE:
May 2014 to January 2016

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$575,000

Objective

Current shipyard constructions methods and practices for dimensional control, layout, and measurement requiring moderate accuracy applications (~0.5" tolerance) can be time-consuming, complex, costly, and require expensive equipment that, in turn, requires extensive experience to operate. For example, rework is common for studs, many being reworked several times before being within accepted tolerance. Distributed fiber optic sensing techniques transform an optical fiber into a flexible cable that measures its own shape and position in 3D space. This Fiber Optic Measurement and Shape Sensing (FOMSS) System, developed by Luna Innovations, provides a time-effective, accurately-aligning manufacturing tool to relieve man-hour investment in set-up, rework, and downtime with applicability to many distance measurement and position registration scenarios. This project refurbishes, upgrades, ruggedizes, and optimizes the prototype FOMSS system developed under a previous ManTech project, with shipyard piloting to occur at Huntington Ingalls Industries - Newport News Shipbuilding (NNS) for characterization system utility in VIRGINIA Class submarine (VCS) and CVN aircraft carrier manufacturing applications.

Payoff

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 advantaged in cramped / confined, close-range layout and verification applications. The system will provide 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 formal acceptance test in July 2015, the FOMSS system demonstrated the ability 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 cost avoidance for VCS and CVN applications, conservatively estimated at $650K–$1.15M per VCS hull and approximately $400K per CVN hull, is to be validated by NNS in the final phase of this project which concludes in FY16. The end result is a robust, field-portable, highly accurate measurement system which provides improved performance and substantial cost savings with applicability to a variety of DOD manufacturing processes and operational conditions

Implementation

First article testing of the FOMSS system will occur at NNS to characterize system utility and the business case for VCS and CVN applications. This facilitates widespread implementation with other shipbuilder and DOD applications to be explored as part of this project. The FOMSS beta unit matured in this project is to be transferred, likely mid-year 2016, to NNS for immediate use in VCS/CVN construction - for locating tile studs, cable hangers, light hangers, wireways, piping runs, and other dimensional control applications. Within months of project completion, commercial versions of the FOMSS system will be produced and made available to all shipyards and other industries with similar requirements.

Improved SHT Tile Manufacturing and Application Will Save VCS Construction Costs

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 necessary for VCS to meet operational requirements and is installed via a bond-in-place (tile) or mold-in-place process, depending upon the location in the hull. The Navy Metalworking Center (NMC) is conducting a ManTech project to evaluate several areas for cost reduction and performance enhancements. General Dynamics Electric Boat (GDEB) reviewed the bond-in-place installation process and materials and the following three areas were identified for further investigation: (1) tile feature modification to aid in installation; (2) tile manufacturing process improvement to reduce cost and rework; and (3) installation material / process improvement to reduce installation time and increase reliability.

The project team established requirements, identified candidate processes and materials, performed multi-staged technical evaluations, and generated a cost-savings analysis to verify that project metrics were being met.

Payoff

Improvements to materials and/or processes will lower the cost to manufacture the tile, decrease installation labor and rework, lower overall installation time, and improve reliability. This project will save an estimated $600K per hull for new construction and $500K per year for fleet maintenance. The bulk of the cost savings will result from improvements to the tile manufacturing process via better casting techniques and machining methods, which will significantly cut material waste and decrease defects. A substantial reduction in labor will also be realized by improving the tile design and application process.

Implementation

The results of this project are scheduled to be implemented for new construction at GDEB on SSN 800 in 2018. Implementation for in-service ships will be coordinated through PMS 392 in 2016. Implementation will occur through changes to manufacturing and installation procedures at GDEB.

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

VIRGINIA Class HDC-1 Bearing Life Greatly Extended

PERIOD OF PERFORMANCE:
August 2013 to September 2015

PLATFORM:
VCS /OR Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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PMS 450

TOTAL MANTECH INVESTMENT:
$380,000

S2573 — HDC-1 Bearing Improvement

Objective

The VIRGINIA Class submarine (VCS) 10-inch Hover and Depth Control (HDC) hull and backup valves are manufactured in accordance with the Submarine Valve Hall and Backup Hovering System Assembly and Details. The valve assembly consists of a poppet valve (hull valve) and a ball valve (backup valve) in a common body. The valves are actuated independently by two hydraulic actuators. There have been recent occurrences of the hull valve failing to operate properly. The failures occurred between two and four years after the valves were placed in service, short of the design goal of six years. The operating problems were a result of failures in the hull actuating mechanism. General Dynamics Electric Boat (GDEB) conducted an analysis to determine the source / cause of the failures. The main cause of the failure is attributed to overloading and lack of lubrication of the split bearing assembly.

The objectives of this Institute for Manufacturing and Sustainment Technologies (iMAST) effort were to determine the failure mechanism, down-select a solution to improve system reliability, and test and demonstrate a system solution(possibly including a material / design modification to address the bearing failures and extend the service life of the HDC-1 valves to 96 months to support increased ship and component availability through the Extended Dry-Docking Selected Restricted Availability (EDSRA) cycle.

Payoff

This project determined the failure mechanism and developed a solution to greatly increase the bearing life. Modifications to the lubrication system in testing show that an extension to 108 months between servicing is achievable. The cost of the bearing assembly is over $5K and the labor to replace the bearing assembly is approximately $40K. In addition, the projected increase to operational readiness by preventing bearing failures is the biggest benefit.

Implementation

Implementation is to occur through GDEB. Together, GDEB and NAVSEA PMS 450/392 are committed to this project as a means to reduce total ownership costs by significantly reducing unplanned maintenance and enabling extension of major availabilities. Implementation will be accomplished through changes to the process specifications for producing the bearing assembly. Technical authority and implementation decisions will be made by PMS 450/392 and GDEB personnel who have been intimately involved with the fabrication, maintenance, and operation. Implementation is expected to begin in third quarter FY16.

Composite Diesel Exhaust Louvers to Replace Steel Louvers for Both Acquisition and Life-Cycle Cost Reduction

M2586 — Composite Diesel Exhaust Louvers

Objective

The objective of this ManTech project for the VIRGINIA Class Submarine (VCS) was to replace the steel diesel exhaust louvers with composite diesel exhaust louvers (CDEL) with the same geometry, thereby reducing fabrication, installation, and maintenance costs. The parts can be molded to shape, CNC machined, will not rust, require little maintenance during the 30-year life and will meet all performance requirements. The VIRGINA Class Block IV Sail Reduced Total Ownership Cost (RTOC) effort started in July 2011 and performed all engineering, design, 3D modeling, and drawing development. The CDEL ManTech project, which began in July 2014, focused on developing a CDEL manufacturing approach which would best produce the two unique complex 3D CDEL louvered geometries most affordably, and with high quality, utilizing minimal tooling while making parts easily repeatable to produce.

Payoff

The principal benefit accrues from acquisition and life-cycle cost reduction due to implementation of composite corrosion resistant CDELs that are less expensive to fabricate and install and that also reduce the amount of maintenance required per scheduled maintenance interval and reduced periodicity of maintenance over the life of the ship.

This ManTech project leveraged the NAVSEA Block IV RTOC Sail Effort. ManTech focused on the manufacturing principles while RTOC focused on the implementation needs such as trials and drawing changes. The ManTech project also provided a reduction in weight (i.e. improved stability) high on the VCS sail. Assuming implementation to start with Block IV of VIRGINIA Class and a 30-ship class, this equates to both acquisition and life-cycle costs; the projected total savings is $200K per submarine, corresponding to a ROI of 15:1. Retrofit on previous blocks is being investigated and will increase the total return on investment to 19:1.

Implementation

The RTOC Team at General Dynamics Electric Boat (GDEB) developed multiple design iterations to achieve a composite design which met all performance requirements and fit within the space provided with no impact to existing systems. The ManTech Team then took that information to various qualified composite vendors to develop the most affordable approach to fabricate the complex composite geometries for the sail diesel exhaust louvers. Goodrich Engineered Polymer Systems, a United Technologies Corporation Aerospace Systems company, was awarded the contract. A cost-effective composite manufacturing approach was developed, and two prototype composite sail diesel exhaust louvers were fabricated. Goodrich also performed visual, dimensional, and ultrasonic inspections which verified the high manufacturing quality. The composite diesel exhaust louvers design is now the design of record and baseline for the VIRGINIA Class Block IV sail with first implementation on SSN 792 with an estimated implementation timeframe of December 2015. In addition, the CDELs may be suitable for retrofit on SSN 792 or earlier boats as well.

PERIOD OF PERFORMANCE:
July 2014 to April 2015

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:
$405,000

Developing CAD/CAM Interface for Steel Processing Efficiency improvements

S2591— CAD/CAM Interface for Steel Shape Processing

PERIOD OF PERFORMANCE:
December 2014 to December 2015

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

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 (OR) Class 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 is 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.

This project includes one set of tasks covering a 12-month period of performance. The first task defines the detailed design requirements, the subsequent five tasks develop and test various capabilities of the software. A demonstration of the tool capabilities will be conducted for all GDEB Stakeholders.

Payoff

This technology, once implemented, could potentially save an estimated $75K per VCS hull and 1.8M per OR hull. These savings will result from increased efficiency in installation due to markings necessary to support component fabrication.

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 first quarter FY16

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 Class submarine (OR) 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 is to develop and validate repeatable manufacturing approaches, and their associated cost and weight impacts, for submarine applications. This project uses 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 include: 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. 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

Significant cost and weight can be 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, thereby affording a comprehensive impact to cost /weigth reduction initiatives compared to historical single component analysis. The deliverables developed as a result of this effort will also 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 will be leveraged to all composites currently on the submarine and to future efforts. This project will demonstrate a production ready composite article that could transition at the end of this Manufacturing Science and Technology effort. Implementation is planned to occur beginning with SSN 792.

PERIOD OF PERFORMANCE:
December 2014 to December 2015

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:
$691,000

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 Composites Manufacturing Technology Center (CMTC) 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, Versathane (Versalink urethane), or HYdrodynamic SHaping MAterial (HYSHMA) (glass microsphere-filled Versalink urethane), or a combination thereof, to form the fairings that make up the boundary of the VPM. Active Office of Naval Research (ONR) development efforts are being leveraged in support of this ManTech project.

Payoff

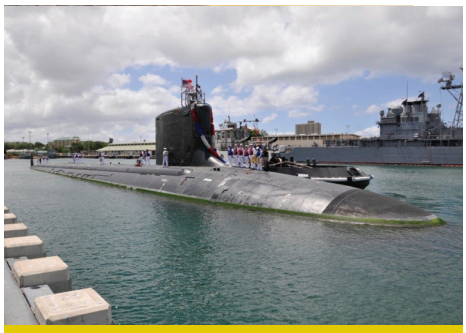
Successful incorporation of the above technologies into the VPM design has the potential to provide significant acquisition and life-cycle savings to the VCS platform for Block V and following ships. Acquisitions savings have been estimated to be between $4 and $12M and life-cycle savings for all of 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. All of the above identified values assume that either hybrid or composite fairings will be selected for use in the VPM design in combination with Non-Metallic Scuppers and a Composite Safety Track. They also assume incorporation of these concepts in each of the 20 ships 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 January 2016 to support VPM arrangement design schedules. Technology development will be 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 September 2016. Over the subsequent 18 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). A final report will summarize results, lessons learned, and steps necessary for defining the plan forward. This final plan will seek to facilitate technology transition so that the information obtained as a result of this ManTech effort can be readily incorporated into shipboard use. After successful completion of the project, technology will be incorporated into the design of the VIRGINIA Class VPM. It is expected that it will also facilitate consideration for similar technology insertion into OR Class components and structures of comparable design / function.

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

S2602— Weld Sequence Planning for Major Assemblies



PERIOD OF PERFORMANCE:
July 2014 to October 2016

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

Objective

Weld-induced distortion on major ship assemblies creates a significant manufacturing challenge and impacts both cost and schedule. This Navy Metalworking Center (NMC) project is developing a user-friendly weld sequence planning tool that quickly determines 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 do this work; however, even an experienced analyst can take days or weeks to arrange, run, and obtain results from detailed weld analysis. This project will enhance commercially available software so that can be easily integrated into existing manufacturing and shop floor systems.

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) will work with multiple commercialization partners to develop a prototype weld sequence planning tool that will be enhanced incrementally. The final tool will be validated with experimental distortion data on a common major VCS/OR assembly. The tool is expected to be implemented at GDEB on SSN 796 starting in the third quarter of FY16.

New Approach for Deck Construction to Have Significant Impact on Two Submarine Programs

S2633— Self-Locating/Self-Fixtured 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

TOTAL MANTECH INVESTMENT:
$1,498,000

Objective

This Navy Metalworking Center (NMC) project will develop the manufacturing process for a new concept of fitting and joining deck structures for the OHIO Replacement (OR) submarine and the VIRGINIA Payload Module (VPM). Deck structures on submarines are typically constructed of many short, fitted pieces (intercostals) between continuous beams. Enabled by a new shape-cutting capability, the self-locating, self-fixtured (SLSF) method will utilize construction with notched beams that interlock and are continuous in both directions. The project will investigate 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 with the minimum amount of distortion and shrinkage. While the construction method is relevant to many platforms, including surface ships, OR and VPM are of particular interest for this technology.

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. General Dynamics Electric Boat (GDEB) estimates that $3.02M can be saved on the first OR hull, and $760K on each of the eight VPM sections in the first five years following completion of the project, for a total five-year benefit of $9.1M. The life of program savings are $46.1M based on 12 OR hulls and 13 VPM sections.

Implementation

Completion of the Large-Scale Test Plan, documented in the Final Report, will be considered the transition point for this project. GDEB and PMS 397 have shown commitment to this solution through their investment in development prior to the initiation of this ManTech project. Those efforts have produced a small (3 beam X 3 beam) grid and preliminary cost savings estimate by an outside firm. Implementation is expected to occur on the lead OR ship and on the VPM of the lead ship of VCS Block 5 in third quarter of FY19. Implementation of this project in OR detailed design should occur in the first quarter of FY17 before detailed design begins, thus avoiding design change costs.

Automation to Improve and Significantly Reduce the Cost of Ship Hanger Manufacturing

S2634 – Automated Hanger Manufacturing

Objective

Shipboard systems use several thousand hangers to install and route pipe, ventilation, and electrical cable throughout the ship. General Dynamics Electric Boat (GDEB) manufactures these parts from metal plate and bar using various manual fabrication steps that are geographically dispersed throughout the fabrication shops. A Navy Metalworking Center (NMC)-led Integrated Project Team (IPT) will evaluate the commonality between part designs, the manufacturing processes used for fabrication, and the material movement between the processes. The IPT will develop an optimized process using work cell principles to create more efficient and streamlined processes. The new processes will be demonstrated to manufacture shipyard hanger assembly components, and pilot studies will be performed to validate the business case analyses (BCA) in support of GDEB's capital expenditure requests. Implementation of the project results will directly impact construction of the VIRGINIA Class submarine (VCS) and OHIO Replacement (OR) platforms.

Payoff

Implementation of mechanized or automated processes to manufacture shipboard hanger assemblies is anticipated to result in an estimated savings of $960K per VCS hull and $1.4M per OR hull. The savings estimate is derived from an anticipated cost reduction to manufacture 20,000 hangers per VCS hull and 40,000 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. The anticipated life of program savings are projected to be $40.8M based on 25 VCS hulls and 12 OR hulls.

Implementation

In order to achieve the savings identified, multiple manufacturing cells might need to be implemented. The implementation will be phased through multiple submittals of capital improvements as the technology improvements are tested and verified. Pilot studies will be performed to validate the BCAs in support of GDEB capital expenditure requests to support full-scale implementation. The project results will be implemented at GDEB in support of the VCS and OR platforms, beginning in the first quarter of FY18.

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:
$1,800,000

Joint Strike Fighter Projects

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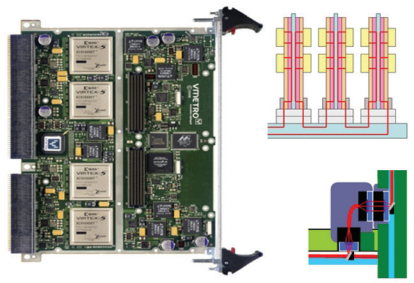
Cost Savings through the Use of Optical Interconnects for F-35



Optical transmission at the printed wiring board level

PERIOD OF PERFORMANCE:
January 2012 to March 2015

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

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

TOTAL MANTECH INVESTMENT:
$2,811,000

A2337 — Photonic Printed Wiring Board

Objective

The objective of this Navy ManTech Electro-Optics Center (EOC) project was to develop processes for optical interconnections in printed circuit board manufacturing. Specifically, this project developed updated methods for fabrication processes for photonic waveguides in printed wiring boards, with focus on the F-35 Joint Strike Fighter (JSF) Integrated Core Processor (ICP) electronics. The project increased performance through higher bandwidth, developed manufacturing processes to facilitate this, and reduced cost by eliminating direct optical fiber connections (pigtails).

Payoff

The F-35 Integrated Core Processor (ICP) demands extremely high performance data processing. The demand for bandwidth is driving the need for optical data transmission to maintain size, volume, complexity, and cost, while substantially increasing performance. This effort prevents processing systems from becoming I/O bound and therefore realizes higher performance for a constant Size, Weight, and Power (SWaP). This project will be the first aerospace implementation of optical waveguides on printed circuit boards, and is being implemented in a facility that can benefit many high performance platforms.

Savings resulting from the transition of the optical transceiver design into the existing supply chain are estimated at $106M, not including transceiver qualification. Further incorporation of photonic circuit board features into ICP modules will further reduce cost and increase optical bandwidth performance.

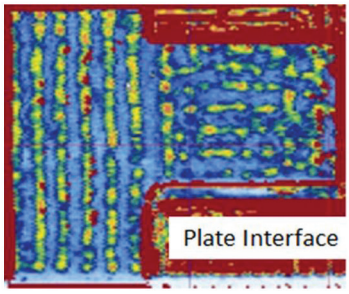
Implementation

The transition event for this project will occur with the build of a F-35 ICP module prototype and proof that manufacturing processes can produce interconnect systems that meet aerospace performance requirements. Prototype module performance using photonic printed wiring board manufacturing technologies, validated against performance and environmental requirements, was successfully demonstrated in 2014. Transition funding is required for the development of an Engineering Change Package that coordinates the configuration changes and qualification necessary to integrate the first whole module design into F-35 LRIP 11 builds. These modules are manufactured at Lockheed-Martin MST in Owego NY, and F-35 assembly occurs at Lockheed-Martin Aeronautics in Fort Worth, TX.

Currently, the use of transceivers in the existing supply chain, and incorporation of ICP module designs which incorporate the new photonic manufacturing processes are being considered by the F-35 Affordability Panel operated jointly by Lockheed-Martin Aeronautics and the Joint Program Office.

NDI Strategy Will Enable Inspection of EBDM Flight-Critical Titanium Components

A2506 — Non-Destructive Inspection for Electron-Beam Additive Manufacturing of Titanium



Objective

Emerging additive manufacturing technologies such as Electron Beam Direct Manufacturing (EBDM) are considered vital to improving affordability, reducing lead time, and reducing industrial shortfalls inherent in traditional manufacturing technologies. Lockheed Martin Aeronautics Company-Advanced Development Programs (LM Aero-ADP) is considering the EBDM process for fabrication of several F-35 Joint Strike Fighter (JSF) components. One of the major obstacles associated with introducing additively manufactured components into the F-35 supply stream is the development and acceptance of adequate non-destructive inspection (NDI) methods and standards to ensure the product meets quality and design requirements. In this Navy Metalworking Center (NMC) project, an Integrated Project Team (IPT) evaluated the effectiveness of traditional and advanced NDI techniques.

Payoff

This project demonstrated the capability of traditional and emerging NDI techniques to ensure reliable quality assurance of EBDM components. The estimated total savings for four JSF components are as high as $45M over 1,006 aircraft, which includes Low-Rate Initial Production (LRIP) from 2016 through 2019 and the first five years of full-rate production between 2020 and 2024.

Implementation

The IPT developed a multi-step NDI process consisting of ultrasonic, computed tomography, X-ray, and fluorescent penetrant inspections for EBDM components. LM Aero-ADP is developing specific procedures for applying those inspection techniques to EBDM material and will submit those procedures for approval by the cognizant Air Force and Navy NDI technical authorities. When approved, these procedures will govern the NDI of targeted airframe components that will be produced using Sciaky's EBDM manufacturing process. The recommended multi-step NDI procedure will be performed at approved NDI vendors under the guidance of LM Aero-ADP. Implementation is planned for LRIP 8, beginning in 2016.

PERIOD OF PERFORMANCE:
September 2012 to April 2015

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
AFRL
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$617,000

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

PERIOD OF PERFORMANCE:
April 2013 to March 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. The objective of this Composites Manufacturing Technology Center (CMTC) project is 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.

The first task, developing specific technologies to reduce the quantity of boot details required per door or panel will be done through F-35 boot fabrication vendors. Door and panel detail families will be identified for each complex boot fabrication technology to quantify total savings to the project.

The second task, developing the UHBC, will leverage internal Lockheed Martin (LM) UBHC and Edison Welding Institute (EWI) work to develop a handheld ultrasonic boot hole cutting device which eliminates certain restrictions with the current development device. The proposed handheld device would use existing processes to accurately locate the fastener holes.

The third task, developing a Boot Adhesive Application System, will eliminate the mixing, application, vacuum bagging, and curing associated with the current two-part epoxy adhesive. In parallel to this effort, LM will be developing an installation process to allow the operator to accurately "float" the PSA-backed (Pressure Sensitive Adhesive) boots into position prior to the PSA adhering to the door or panel

Payoff

The payoff will be a significantly reduced cost for fabricating and installing boots on F-35 doors and panels. Estimated cost savings as a result of this development effort 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 is expected to complete in time for a 2016 implementation.

Improved Automated Polishing Process to Reduce Labor-Intensive Iterations

A2534 — F35-Transparency Clean-up Automation

Objective

The solution to the problem of labor-intensive hand sanding of fighter jet canopies transparencies is to utilize a modern industrial robot with a vibratory polishing head. By including precise position and force feedback to the sanding head, the robot can be 'trained' to duplicate the hand sanding methods to remove simple surface mark-off, light scratches, and surface texture. The U.S. Air Force funded a highly successful Automated Sanding STTP with Aerobotix Inc. via the Small Business Innovation Research vehicle to develop a precision sanding system utilizing state-of-the-art robotic arms and force control systems. These systems were used to develop methods for sanding coatings and surface fillers on-aircraft in areas of complex geometry.

Both sanding with heavier grits and polishing with fine rouge-type materials are required to provide a clean optical surface. Additionally, the critical coating and bonding operations for the transparency require sanding with various grits to improve adhesion and coating durability. As acrylic is much softer than other material previously sanded with the Aerobotix technology as well as subject to optical requirements, additional development work is required to adapt the technology to transparent materials. Both subscale and full-scale work is required as some optical problems only show up over larger or more curved surfaces.

Payoff

This project is expected to provide a number of significant benefits to the Navy and other F-35 customers. Total savings are estimated at $160M in recurring canopy procurement. These improvements are significant, especially as manufacturing capacity has been a concern on legacy canopy and windshield programs in the past.

Implementation

This ManTech effort has taken the necessary steps to ensure that a low-cost method of automated initial transparency clean-up that meets the requirements of the program and is safe for operator use has been demonstrated. A fully functional transparency automation prototype system has been built and proven on production-equivalent canopy transparencies. No qualification testing is anticipated to be required at this time. Simple testing has been conducted during the automation program to ensure that the process does not impart polishing stresses into the acrylic surfaces. The technologies developed are working through the implementation steps required by the F-35 Affordability process. No issues are expected at this time and implementation is estimated for FY16.

PERIOD OF PERFORMANCE:
November 2013 to January 2015

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:
$1,116,000

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

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:
$500,000

A2535— F-35 High Fidelity Fastener Feature Measurement

Objective

The goal of this Composites Manufacturing Technology Center (CMTC) project is development of a non-contact laser measurement device for measurement of surface feature flushness on the aircraft production floor. The first step will consist of developing a full set of requirements for a production device. Those requirements will be used to establish initial system parameters and component selection. Module level testing will verify that the components selected and the initial algorithms meet the requirements set forth. Upon successful completion of module level testing, the full system will be developed and tested. Testing of the full scale system will initially consist of lab scale use and will culminate in testing on the aircraft production floor. The final task will consist of manufacturing analysis and planning for the handheld scanner. The results of the program will provide aerospace prime contractors with sufficient information to make a production implementation decision. The system will be designed to measure the specific surface feature relative to the profile of the outer skin of the aircraft.

Payoff

This system is anticipated to improve upon current surface measurement processes in terms of measurement quality and measurement time. At present, only a couple of points on the surface feature are measured while the new system is anticipated to provide the capability to measure the entire surface of the feature of interest. Additionally, the present system is highly dependent upon operator skill whereas this new system will fully characterize the surface feature without dependence on operator skill, producing a more accurate and repeatable measurement. Upon implementation, this technology is estimated to result in a total cost savings of over $13M. Finally, the technology developed on this program is intended to be transitioned to other measurement applications providing for an additional estimated cost savings of $13.2M.

Implementation

At the successful conclusion of this ManTech effort, the necessary steps will have been taken to ensure that a low-cost method of surface feature measurement has been demonstrated that meets the requirements of the program and is safe for operator use. A fully functional measurement hand tool will have been built and proven on production-equivalent aircraft parts. No qualification testing is anticipated to be required at this time. In addition, the cost benefits of adopting the technology on the production floor will be 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.

Technology to Reduce the Occurance of Out of Contour Waviness Defects

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.

PERIOD OF PERFORMANCE:
November 2014 to April 2017

PLATFORM:
F-35 Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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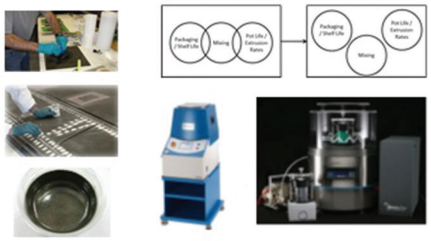
STAKEHOLDER:
PEO (JSF)
F-35 Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$2,900,000

Automated Material Mixing Procedures to Provide a More Consistent Product



A2587-— Automated Material Mixing for F-35

PERIOD OF PERFORMANCE:
April 2015 to July 2016

PLATFORM:
F35- Joint Strike Fighter (JSF)

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

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

TOTAL MANTECH INVESTMENT:
$725,000

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.

This project is a joint COE effort between Composites Manufacturing Technology Center (CMTC) and Institute for Manufacturing and Sustainment Technologies (iMAST).

Payoff

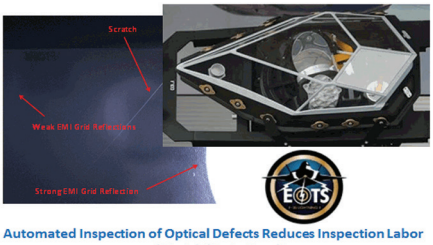
Automated mixing of the F-35 material reduces hand mixing costs and provides a more consistent product improving first-time yield by reducing non-conformance tag repair activity labor and material. An estimated $34.2M program cost savings is expected to result from this project.

Implementation

Technology developed by Applied Research Laboratory 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 late 2016.

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 (7 panels, interior and exterior) and analyzing the data to produce results based on Mil-Spec standard (Mil-PRF-13830B) 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 impact optical quality and increase the probability of mechanical failure will be characterized. This includes scratch, dig, pits, and scuffs which diminish the infrared transmission and reduce the sensor imaging performance as well substrate defects 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 nearly $7M 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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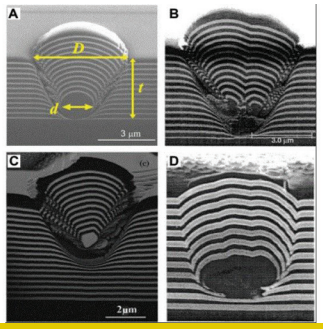
STAKEHOLDER:
PEO (JSF)
F-35 Joint Program Office (JPO)

TOTAL MANTECH INVESTMENT:
$1,116,000

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 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-method approach: (1) reduce the formation of nodule defects through an 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.

Technology developed in this project will significantly reduce 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 Joint Strike Fighter (JSF), an estimated $6K per aircraft cost can be avoided through InSb (Indium Antimony) die reductions.

Implementation

The primary transition platform for this project is the F-35 EO/DAS (Electro-Optical Distributed Aperture System) sensor system. Process improvements to the incumbent coating process will be implemented within weeks of ManTech project conclusion in FY17 since these process affect only the plant work instruction. Implementing a new process such as laser ablation will require a documented process change and either capital purchase or supplier qualification, which could be implemented in early FY18.

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 (SBF) (a Lockheed Martin Missile and Fire Control business) 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 Electro-Optical Targeting System (EOTS) Productivity Task) consists of two tasks: FPA Quick Test Phase 2 and Improved Dewar Final Vacuum Bake, resulting in 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 is the targeted platform. These 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

Other Sea Platforms Projects

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SPS-48E Radome Manufacturing and Slat Refurbishment

PERIOD OF PERFORMANCE:
September 2013 to February 2016

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:
$693,000

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 were found to be 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.

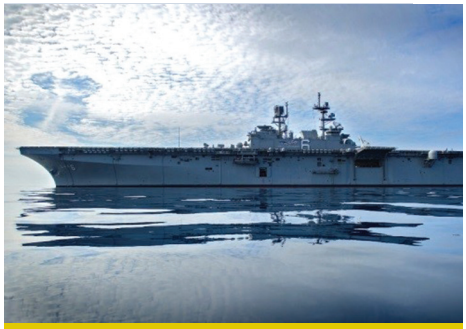
A new adhesive substitute will be identified to reduce the overall cost of both the materials and the amount of labor required to cure the current material. The new material will also be color-matched to the antenna reducing the overall cost of refurbishment. The total costs savings per system will be 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 in FY18.

Minimizing Build Strategies Through Modular Outfitting and Packaged Units

S2556 — Modular Outfitting / Packaged Units



PERIOD OF PERFORMANCE:
September 2014 to March 2016

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Advanced Manufacturing Enterprise

CENTER OF EXCELLENCE:
NSAM

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STAKEHOLDER:
PMS 377

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 is a two-phased project over 18 months with the first phase consisting of identifying opportunities for modularity and conducting an impact assessment prior to transitioning into Phase 2. The Phase 2 effort will develop and demonstrate a build strategy tool / process and pilot the tool for validation.

Payoff

This technology, once fully implemented, expects to reduce labor hours for current activities by eight percent (23,600 man hours) which equates to a cost savings of $1.8M per LHA hull. This will provide improvements in productivity and efficiencies, a reduction of outfitting hours, and could also improve health and safety conditions for employees.

Implementation

The Modular Outfitting project team is developing and will demonstrate, through actual examples, a build strategy assessment tool / process with the goal of standardizing the methodology for evaluating / changing the current build strategy approach for a ship program. The build sequences will be examined in detail to identify possible changes to processes and design that could lead to significant cost savings. Ingalls anticipates deploying the solution in the first quarter FY16 on LHA 7 after initial acceptance tests are completed

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

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 passage ways. This causes interference, disruption, damage to doors and equipment, and contributes to trip safety hazards. In today's economy, it is crucial that construction costs are reduced for naval ships. Ingalls has identified temporary services as an area where money can be saved and through additional planning and routing of temporary services and technology insertion. This project at Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) is focused on improving the process and/or equipment Ingalls uses to provide craftsmen with utility and support services. The project will optimize current processes and equipment used to provide temporary services during ship construction. The primary focus is on ventilation, scaffolding, and the planning and kitting of temporary services however the team is evaluation all process for improvements.

This is a two-phased project over 18 months with the first phase consisting of identifying and defining the needs and requirements. Phase 2 will pilot the Temporary Service Optimization cost savings opportunities.

Payoff

This project will eliminate the need for excessive utility lines and reduce redundancy, clutter, rework, and increase organization efficiency in each temporary service type. This technology, once fully implemented, could reduce labor hours for current activities by approximately four percent (10,402 man hours) with an estimated $780K cost savings per LHA hull.

Implementation

The project examines concepts and processes to provide utility services with lesser footprint and damage, lower cost and disruption with opportunities for technology insertion. Upon completion, Ingalls will update process documents for temporary services (validated by project), purchase new products / technology (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 will occur prior to June 2016 which allows for cost savings on a portion of LHA 7 and all future LHA and DDG hulls.

Mechanized Tools for Significantly Improve Cable Pulling on Surface Ships

S2560 — Mechanized Cable Pulling

Objective

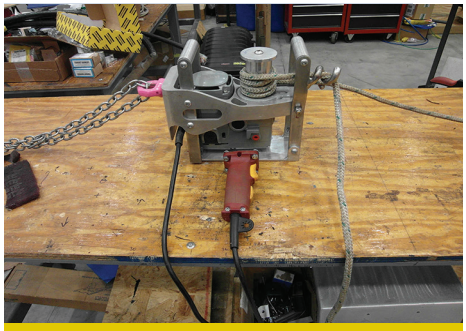
The objective of this Navy Metalworking Center (NMC) project was to develop easy-to-use, small, lightweight, portable, power-assist tools to reduce the amount of effort and time required to pull cable on surface ships. Depending on the size, length, and cable routing path, it can take upwards of 25 workers to pull a single cable. The Integrated Project Team (IPT) developed two tools during this effort: a capstan tool (up to 2,000 lb pulling capability; equivalent to ≈ 40 workers), and a dual roller tool (up to 400 lb pulling capability; equivalent to ≈ 8 workers). These tools can be used separately or together to apply a controlled pulling force while routing or manipulating the cable (primarily 1.5" – 2.25" diameter) along the intended path, which can be straight, twisting, and/or turning. Field trials at Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls) on DDG 113 demonstrated that use of these tools resulted in a 50 percent reduction in both labor hours and the number of personnel required to pull the cable.

Payoff

To date, project results have surpassed the target goal of a 15 percent reduction in the labor-hours required to pull cable. This equates to 32,500+ labor-hours at Ingalls for LHA, LPD, DDG 51, and NSC class ships and 6,200+ labor-hours at Huntington Ingalls Industries – Newport News Shipbuilding (NNS) for CVN Class aircraft carriers. The total five-year cost savings for the identified platforms at both shipyards will be more than $4.7M. In addition, reducing workers' cable pulling exposure time will decrease the number of associated injury claims, further reducing the production costs.

Implementation

Implementation is targeted for the first quarter of FY16 at Ingalls and NNS on all identified platforms.



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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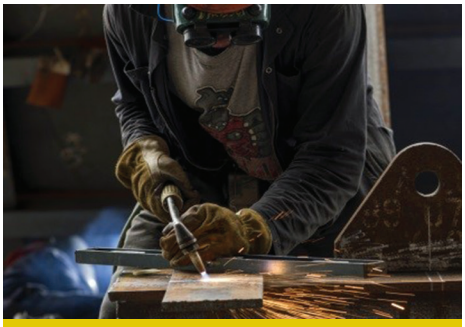
STAKEHOLDER:
PMS 377
PEO Ships (AMPHIBS)

TOTAL MANTECH INVESTMENT:
$1,577,000

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 LHA Class ships 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 those solutions. In particular, the project identified and developed hull assembly fixturing, along with automated and/or mechanized processes for layout, cutting, and welding. These methods will enable better hull fit-up, weld quality and efficiency; streamline the installation and removal of temporary attachments that are needed for construction and transport; and increase the efficiency and quality of the installation of high-volume repeatable parts.

Payoff

Improvements to the hull production processes identified are anticipated to result in a cost savings of $6.7M across LHA, LPD, and DDG platforms built at Huntington Ingalls Industries - Ingalls Shipbuilding during a five-year period due to labor savings. Additional affordability benefits will be seen 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

Implementation of the project solutions began in the third quarter of FY15 on LHA 7 and DDG 117. Ingalls currently plans to make capital investments of approximately $1M to integrate the project solutions into hull production.

Automated Pipe Production Methods Anticipated to Save $7M on Several Ship Classes

S2565 — Pipe Production Automation Methods

PERIOD OF PERFORMANCE:
November 2013 to July 2015

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
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STAKEHOLDER:
PMS 377, PMS 500
PEO Ships (AMPHIBS)

TOTAL MANTECH INVESTMENT:
$1,044,000

Objective

With several thousand pipe welds on Navy ships, even a slight reduction in manufacturing time can result in significant cost savings. The Navy Metalworking Center (NMC) conducted a project to investigate and develop portable mechanized tools and automation technologies to improve pipe fitting, welding, and installation on several naval platforms manufactured at Huntington Ingalls Industires - Ingalls Shipbuilding (Ingalls), including the LHA(R), LPD, and DDG 51 classes as well as the U.S. Coast Guard's National Security Cutter (NSC). NMC worked with Ingalls to identify, develop, and enhance several technologies and tools to support automation / mechanization of pipe production processes. Specifically, the three main technologies investigated were automated pipe welding with an orbital welding system, enhanced brazing techniques using a ring burner and a hook-style torch tip, and improved fitting and rounding of pipe ends leveraging an assortment of both commercial and prototype tools. Ingalls tested and evaluated the technologies and tools throughout the project. The most effective methods were down-selected for time trials and subsequent implementation.

Payoff

These improved pipe production tools and technologies are expected to reduce the cost of manufacturing thin wall piping system components at Ingalls. Based on pilot studies performed, the total targeted five-year cost savings are approximately $7M for the five awarded DDG 51 hulls, two NSC hulls, plus the projections for future amphibious and LHA(R) hulls

Implementation

Further field trial investigations along with qualification and training are required before the automated welding system and brazing technologies are implemented. Meanwhile, several commercial and prototype fitting tools are being transitioned and pursued for implementation. With input from Ingalls, NMC identified, developed, tested and refined several unique pipe fitting and rounding tools. The prototype tools developed either can be manufactured in-house at Ingalls or by any appropriately equipped machine shop. NMC also identified several potential commercialization partners and obtained budgetary pricing to support Ingalls' capital expenditure requests. Due to successful demonstration and tool validation, Ingalls has implemented three pipe fitting and alignment tools (the NMC split-ring clamps, NMC enhanced plug rounding tool, and the Intercon Enterprises pipe alignment clamp.) Ingalls plans additional purchases of these tools for use throughout the shipyard on all platforms constructed at Ingalls. A phased implementation approach started in July 2015, with full implementation expected prior to completion of LHA 7.

Portable System to Mitigate Aluminum Cracking to Provide Significant Cost Avoidance

PERIOD OF PERFORMANCE:
September 2013 to September 2015

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

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

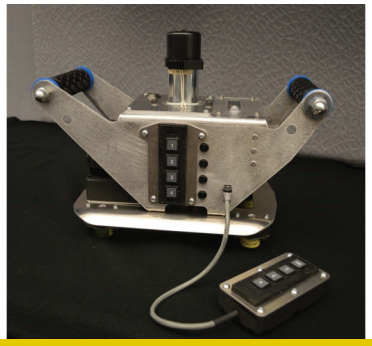
Reverse sensitization will give the Navy a low-cost alternative to the current process of cutting out and replacing the sensitized plate. The reverse sensitization repair process can save as much as $1.7M per CG 47 ship. The technology could result in a cost avoidance of as much as $25.5M for 15 ships serviced within five years. The Littoral Combat Ship (LCS) program will also benefit from this improved technology at a conservative estimated cost of $500K 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 will be incorporated into a portable system that can impart the necessary heat to a shipboard component. The prototype system will be tested on decommissioned CG 47s before being turned over to a commercialization partner for use during maintenance intervals. A specification for use of the system also will be developed, so that additional units may be built after successful implementation. The new process is expected to be implemented at Huntington Ingalls Industries - Norfolk Naval Shipyard (NNS) on CG 52 through CG 73 starting at the beginning of calendar year 2016.

Modified SHT Debond Detector to Save Costs on In-Service VCS hulls

R2607 – Debond Detector Improvements



Objective

The Strategic and Attack Submarines Program Office (PMS 392) requested that the Navy Metalworking Center (NMC) modify its recently developed special hull treatment (SHT) debond detector (developed under ManTech project S2363) to meet the needs of Navy shipyards. The system uses impulse hammer technology to replace manual inspection of SHT on VIRGINIA lass submarine (VCS) hulls. Based on feedback from the Navy shipyards after demonstrations of the original debond detector, PMS 392 funded this effort to modify the system for in-service use. The changes included enabling the inspection unit to move in multiple directions on the surface (circular instead of linear), improving the operator interface, and adding the ability to connect directly to a 110V power source in addition to being battery operated.

Payoff

The modified SHT debond detector will improve the accuracy and consistency of SHT debond inspection, which will reduce false positives and the overall cost of SHT repair. It also will reduce training time and operator skill level required to perform debond inspections.

Implementation

NAVSEA approved the use of the debond detector as the primary tool for detecting debonds of SHT material on USS HAWAII (SSN 776) during its upcoming extended dry-docking selected restricted availability. Additionally, the SHT Maintenance and Repair Manuals will be revised by September 2015 to incorporate the debond detector as the preferred tool to inspect for debonds. Seven debond detectors were delivered in June 2015 to the Navy for use on future VCS availabilities. Additional units can be purchased from the commercialization partner, Enterprise Ventures Corporation

PERIOD OF PERFORMANCE:
September 2014 to July 2015

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processing

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NAVSEA
PEO Ships
PMS 392 T

TOTAL INVESTMENT:
$202,000

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 and 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 with rapid design modification, testing, and production. Additive manufacturing (AM) has been proposed to meet those challenges, but AM is subject to dimensional distortion. To address that issue, the Navy Metalworking Center (NMC) is conducting a project to quantify the efficacy of various dimensional distortion mitigation approaches. An Integrated Project Team (IPT) will evaluate factors such as alloy composition, process parameter manipulation, and post-build heat treatment in manufacturing chassis for electronics 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.

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

Fabrication of metal electronics chassis using evolving AM technologies offers the Navy the ability to produce new chassis designs with up to 30 percent less 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 to 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.

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

S2642– 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

Energetics Projects

S2214 — Flexible Manufacturing of Novel Energetic Materials (Flex NEM) 106
A2514 — C-1 Diol Redevelopment 107
A2575 — Energetics Production Utilizing Resonant Acoustic Mixing (RAM) 108

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 that has been conducted focuses 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, need 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 IHD has completed site preparation for reactor installation to support manufacture of novel energetic ingredients such as LLM-105, DAAF, and PNO at a 500-gallon scale. Once DAAF process-specific programming and controls are completed, the capability of producing LLM-105, DAAF, MAZT, and other novel energetic ingredients at the 500-gallon scale for Department of Defense (DOD) weapon systems will exist. This technology is planned for insertion into Navy programs such as the Hellfire thremobaric warhead. Additionally, this flexible manufacturing capability will have the ability to provide a variety of new energetic material ingredients for use in propellants and explosives.

Domestic Source and Process for Manufacturing of Critical Bonding Agent for Propellants

A2514 — C-1 Diol Redevelopment

Objective

C-1 Diol is used as a bonding agent in the manufacture of propellants which employ polyurethanes as binder systems (, such as the Harpoon Missile program); and is also a critical chemical for the production of the Harpoon Missile Booster. Without the bonding agent, further production of the solid propellant booster is not possible. The past manufacturer last produced the material in 2005 and is no longer interested in producing future quantities of C-1 Diol. Department of Defense (DOD) contractors responsible for producing Harpoon Missile motors require a current stable source of this material due to diminishing stockpiles of the C-1 Diol. Additional DOD contractors have also expressed interest in the availability of C-1 Diol for their future programs. The objective of this project was to provide a domestic source for 2, 3-dihydroxypropyl bis (2-cyanoethyl) amine (C-1 Diol) which meets specification AS 2325A SCN 1.

Payoff

The DOD and their support contractors will have a domestic source for C-1 Diol. The manufacturing knowledge gained from this effort will allow for a stable source for C-1 Diol for the current DOD program needs and provide the technical basis for further scale-up if needed to meet future DOD requirements. As a result of this project, the Navy will not only have a source for C-1 Diol that meets specification, they will also have a thorough understanding of the manufacturing process as well as a stable domestic source of the material. Future scale-up of C-1 Diol for production will be available if requirements grow.

Implementation

Process redevelopment on the chemical process for producing C-1 Diol started in December 2014. Once the process is deemed repeatable, it will be scaled- up to the pilot-scale for production of material for testing to AS 2325A SCN 1 and ultimately qualification in Harpoon Missile propellant production. A production ready lot of C-1 Diol will be provided and ready for implementation late 2015.

PERIOD OF PERFORMANCE:
June 2012 to June 2015

PLATFORM:
Energetics

AFFORDABILITY FOCUS AREA:
Not Applicable

CENTER OF EXCELLENCE:
EMTC

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STAKEHOLDER:
NAVAIR
PMA 201

TOTAL MANTECH INVESTMENT:
$1,196,000

RAM Technology Provides Safer and Cheaper Manufacturing of Energetic Materials

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

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STAKEHOLDER:
PEO (IWS)

TOTAL MANTECH INVESTMENT:
$1,489,000

A2575 — Energetics Production Utilizing Resonant Acoustic Mixing (RAM)

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 off-set 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

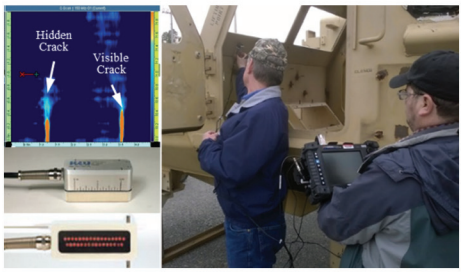
The successful completion of this project will result in a fully operational resonant acoustic mixing production facility at NSWC IHEODTD, as well as a qualified RAM production process for the Mk 152 warhead to meet PMA 242 requirements. Direct transition to full production is anticipated following successful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

Techniques and processes developed will support RAM programs elsewhere. Allegheny Ballistics Laboratory (ABL) has 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

C2477 — Crack Detection in USMC Vehicles 110
S2580 — Cold Spray Technology for Shipboard Components 111
S2599— UHP SHT / MIP Removal Using Dual-Track Crawler System 112
A2647 — Additive Manufacturing Repair of AV-8 LPC Seal 113

Under-Paint Inspection Technology to Improve Depot Maintenance Planning for Ground Combat Vehicles



C2477 — Crack Detection in USMC Vehicles

PERIOD OF PERFORMANCE:
January 2012 to February 2015

PLATFORM:
RepTech

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
MARCOR
LOGCOM

TOTAL MANTECH INVESTMENT:
$470,000

Objective

Currently, the U.S. Army and U.S. Marine Corps (USMC) depots completely disassemble vehicles to remove camouflage, topcoat, and primer paint to inspect for cracks. The inability to detect cracks without disassembly and paint removal results in wasted time and funding. The objective of this project is to define and implement a new or modified non-destructive evaluation / non-destructive testing (NDE/NDT) technique for inspection of large assembled and painted USMC combat vehicles and other deployable vehicles assigned to the depot. The USMC 2014 Strategic Plan includes refurbishing 925 Light Armored Vehicles (LAVs) and approximately 1,500 MRAP-All Terrain Vehicles (M-ATVs). Each of those vehicles, using the current inspection procedures, would require all paint removed prior to evaluation. The goal of this project was to avoid unnecessary paint removal by introducing new NDE technology that will accurately identify structural cracks through paint. In accordance with Albany MCLB approved inspection requirements, if cracks of sufficient size and shape are not detected, no structural or protective repair is necessary.

Review of inspection reports for 259 LAVs revealed approximately 30 percent of the vehicles had no more than one crack. For these vehicles, a robust NDE method capable of locating cracks through the paint would enable, low-cost repair and overhaul. Additionally, 50 percent of cracks discovered were in 5 easily accessible locations on the exterior hull of the LAVs. Detection of easily accessible cracks would obviate the need to disassemble and remove paint in pristine areas of the vehicle. The successful implementation of a robust inspection technology will provide the vehicle-specific structural assessment for improved depot repair and re-paint process logistics.

Payoff

Eight hundred vehicles are processed through USMC Maintenance Depots each year. The proposed crack detection inspection process may only require removal of paint from damaged areas. Assuming only 25 percent of total vehicle areas will require paint removal and repaint as a result of damage and repair – cost savings are estimated at $4.23M per year for a five-year return on investment of more than 47:1.

Qualitative benefits from this project include: increased vehicle availability, better production planning process, improved painting throughput, reduced hazardous waste stream (less paint and blast media), flexible pre-repair planning for material acquisition.

Implementation

The through-paint inspection technology, including relative NDT calibration standards, developed through this project has been used to date at MCLB Albany. The Technical Warrant Holder (TWH), MDMC, will have decision authority for fully implementing this new non-destructive inspection protocol that was successfully demonstrated at Albany, Georgia on depot vehicles. Full implementation is expected to begin in early FY16.

Cold Spray Technology for Repair of Shipboard Components to Reduce Costs

S2580 — Cold Spray Technology for Shipboard Components

PERIOD OF PERFORMANCE:
June 2014 to April 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

Objective

Puget Sound Naval Shipyard (PSNSY) and the Intermediate Maintenance Facility (IMF) have identified several repair and maintenance issues on aging sea water exposed components due to corrosion of the base metal. Components that routinely need repaired / replaced include valves, pumps, actuators, and periscope masts. The components are made of different materials including Al-6061-T651, brass, Monel (~70Ni-30Cu), 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 is 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 are validation of the process parameters and coating properties, qualification test results, process parameters, material and process parameters, and coating procedures.

The cold spray process is being developed as an alternative repair process for several of the repairs that have been 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 (ROI).

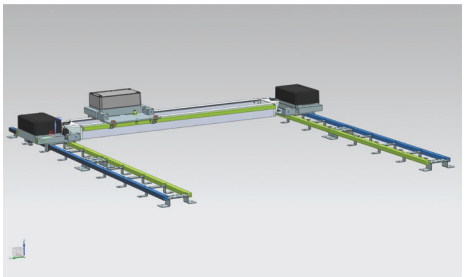
Payoff

The payoff include 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

Implementation of the repair processes will be through PSNSY. A business case analysis will be conducted to determine the most cost-effective and efficient implementation path. The analysis will include parameters such as equipment costs, workload, equipment maintenance, and need for qualified operators. Options include installing and maintaining cold spray equipment at PSNSY, performing repairs at a vendor location, or having a vendor perform repairs on-site. Final implementation is expected to occur fourth quarter FY16.

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

PERIOD OF PERFORMANCE:
September 2014 to September 2016

PLATFORM:
RepTech

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
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STAKEHOLDER:
NAVSEA

TOTAL MANTECH INVESTMENT:
$512,000

Objective

Removal of Special Hull Treatment (SHT) from submarine hulls is performed using an ultra-high pressure (UHP) water jet. 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 the waste cleanup process

Payoff

According to Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNSY&IMF) an estimated 1000 man-hours were expended (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 the elimination of the operator safety limit (60-minute blast-time restriction), elimination of the frequent cycling the trigger on and off due to poor visibility, and elimination of the requirement to maintain a second person as safety watch.

SMEs estimate the shipyards will see a 50 percent reduction in cleanup cost as a result of the reduced cleanup labor with the introduction of an on-board vacuum collection. 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. Finally SMEs estimate approximately a 35 percent reduction in labor for edge cleanup prior to reinstallation of new tiles.

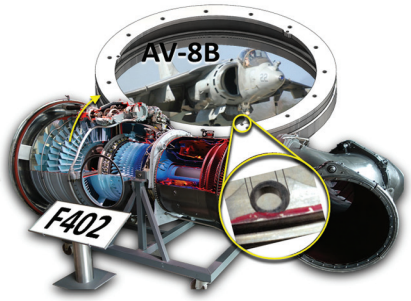
The estimated total cost savings per hull is $120K per year/per yard and the estimated total annual cost savings to the Navy is $360K/year. The return on investment over five years is: 3.5:1

Implementation

The Institute for Manufacturing and Sustainment Technologies (iMAST) plans to demonstrate the system at PSNSY&IMF in the first quarter FY16. The transition path is direct technology insertion at the submarine-supporting shipyards. System complexity is at an appropriate technology level for maximum transition ease.

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

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, fabrication of repair parts, and refurbishment of worn or corroded parts. The AV-8B aircraft employs an F402 engine from Rolls Royce that experiences wear at bolted contact points on the low pressure compressor Stage 2 seal ring. There is no currently approved repair, so NAVAIR must rely on replacement from a vendor with long lead-time.

The objective of this project is to develop and implement a qualified laser-based directed energy, deposition buildup repair process for this component. However, before this potential can be realized for aviation components, the U.S. Navy must develop and demonstrate repair qualification and certification procedures for specific targeted components. This Institute of Manufacturing and Sustainment Technologies (iMAST) project will advance AM technology for both manufacturing / fabrication 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 East (FRC East) or a designated 3rd party. These procedures will address a high-priority repair need within the AV-8B F402 engine — excessive vibration due to surface wear on the Low Pressure Compressor 2nd Stage Rear Seal Ring at bolted contact points to the 3rd Stage Rear Seal Ring.

Payoff

A key payoff for the Navy 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 forecast provided by FRC East suggested that the projected number of spare seal rings is expected to be exhausted, and AV-8B aircraft will be grounded by mid-2016 if another re-supply order is not filled or another source of manufacture / repair is not established beforehand.

The cost avoidance and operational benefit associated with avoiding having multiple jets grounded for several months in 2016 has been stressed to the project team by FRC East as motivation to pursue suitable AM repair options for these units. Moreover, the headway 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) successful completion of the project, (2) acceptance of the technology by the Program Office, Program Executive Officer (PEO) and/or the Management Representative of the Industrial Facility, and (3) acceptance by the relevant Navy Technical Code. The iMAST project team and NAVAIR stakeholders are working toward a late FY16 implementation.

PERIOD OF PERFORMANCE:
March 2015 to December 2016

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

DOD ManTech Projects

Z2495 — JSF Electro-Optical Targeting System (EOTS) Productivity Task 116

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.

Improving Producibility of the F-35 EOTS Mid-Wave Infrared Integrated Dewar-Cooler Assembly

JSF Electro-Optical Targeting System (EOTS): Improving manufacturing readiness and reducing costs of Infrared FPAs and associated IDC technology

PERIOD OF PERFORMANCE:
March 2012 to September 2015

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
OSD DMS&T

TOTAL INVESTMENT:
$4,620,000

Z2495 — JSF Electro-Optical Targeting System (EOTS) Productivity Task

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 detector (the Integrated Dewar-Cooler Assembly or IDCA, which is the sensing component of the EOTS) suffered from low yield and production inefficiencies, unable to meet LRIP rates and cost bogeys. Investments in yield and automated manufacturing technologies were required in order to meet F-35 Program cost and production rate targets. Navy ManTech's Electro-Optics Center (EOC) and Santa Barbara Focalplane (SBF) worked with Air Force ManTech, OSD DMS&T, and the F-35 Joint Program Office to improve the manufacturing readiness and reduce costs of the infrared focal plane arrays (FPAs) and associated Integrated Dewar Cooler technology.

Payoff

This project implemented a variety of automated and semi-automated manufacturing improvements benefiting the MWIR IDCA used in the F-35 EOTS and other DOD targeting payloads. Realized benefits include: (1) a significantly improved Manufacturing Readiness Level (from MRL 4 to MRL 8), (2) increased reliability and repeatability, (3) a 19 percent reduction in cost per unit (reduced scrap and hours-per-unit), (4) a greater than 60 day setback for EOTS delivery schedule - removing EOTS production from the F-35 schedule critical path, (5) $117M in acquisition affordability savings including spares, (6) applicability to other military platforms such as Sniper/Advanced Targeting Pod Payloads on the F-15, F-16, B-1, A-10 and B-52, and (7) a projected Return on Investment of 25.

Achievement of the F-35 JPO's LRIP and full rate cost and rate bogeys would not have been possible without this ManTech effort.

Implementation

EOTS manufacturing improvements developed under this project were implemented at SBF with direct application to ongoing and future delivery lots, beginning with EOTS LRIP 6 with full realization of benefits by LRIP 8. Cost savings and throughput improvements were characterized for each task as it was transitioned and cut into production. A sufficient number of production runs was completed to obtain statistical evidence that the cost and capacity goals can be maintained over long production runs. A comprehensive analysis at the end of the project revisited these benefits, further realizing learning curve improvements, scrap reduction savings, and other and cumulative/collateral impacts. The MRL level was improved from 4 to 8 with EOTS detector production capacity increased and per unit acquisition costs reduced. All these producibility improvements benefit the Advanced EOTS roadmap for future F-35 upgrades.

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