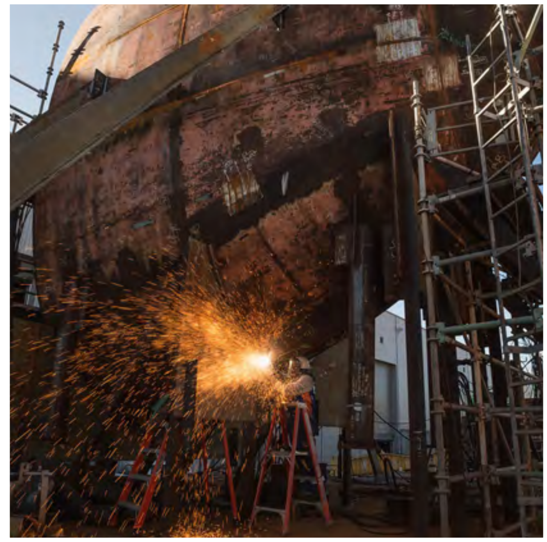
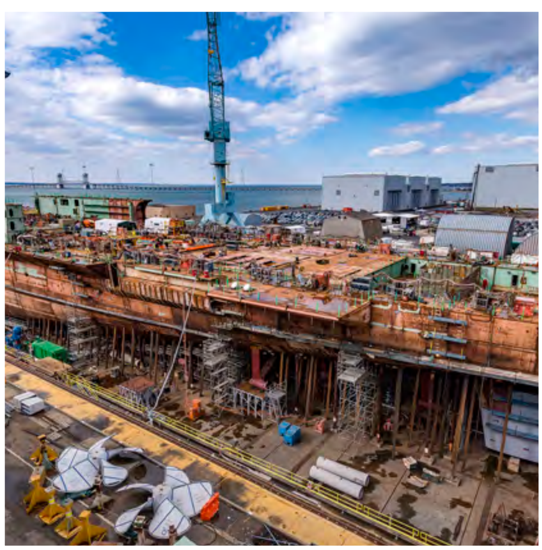


...transitioning affordable manufacturing technology to the fleet

2019 Navy ManTech
Project Book



Contents

2019 Navy ManTech Project Book: This edition of the Navy ManTech Project Book provides brief write-ups for most of the Navy ManTech projects active in FY18. To highlight Navy ManTech's cost savings investment strategy, with its concentration on development of manufacturing technology for the key platforms, the projects are organized by platforms. Please contact the points of contact listed in the project summary for additional information on any Navy ManTech project.

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NOVEMBER 2018

The Navy Manufacturing Technology (ManTech) Program has been helping improve 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. For FY19, we will continue to focus on the VIRGINIA Class submarine (VCS), COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class aircraft carrier, F-35 Lightning II, and CH-53K heavy lift helicopter. Looking to FY20, Navy ManTech is broadening its investment strategy to support the FFG(X) Next Generation Frigate as well as select manufacturing technology projects that accelerate the delivery of capabilities to the Navy.

Implementation is the end goal of our program. While the resources for implementation are provided by organizations other than ManTech, much of our effort and many of our processes are focused on ensuring that ManTech projects successfully transition to the end user and ultimately reduce the cost to manufacture Navy ships and aircraft. For example, Technology Transition Plans, which are required for every project, specify what will be accomplished with ManTech funds, the exit criteria to complete a project, and the resources that will be funded by other entities to actually implement the technology.

In addition, Navy ManTech continues to use an implementation risk assessment and management process to assess both 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 acquisition and industry stakeholders. For projects in the planning phases, the goal is to recognize the risks to implementation upfront and, by doing so, prioritize funding of affordability projects that have the greatest probability of implementation.

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

The Navy ManTech Points of Contact Directory provides a comprehensive source of information on the Navy ManTech Program, its investment and execution strategies, and contact information for its key players. I hope that it is a valuable resource for members of industry, government, and academia.

I look forward to working with all of you as we continue to improve the successes of the Navy ManTech Program. It is more critical than ever to put our resources to the best use, and I am confident that the continued collaboration of ManTech, Program Executive Offices, and industry on cost-reduction opportunities 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 helps reduce acquisition and total ownership costs by developing, maturing, and transitioning key manufacturing technologies and processes. Investments are focused on those that have the most benefit to the warfighter.

For over 11 years, the Navy ManTech Program has been focused on affordability improvements for key acquisition platforms. Our current investment strategy includes the VIRGINIA Class submarine (VCS), COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class aircraft carrier, F-35 Lightning II, and 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 $ per hull or $ per aircraft).

Navy ManTech works with defense contractors, the Naval Research Enterprise, Navy acquisition Program Offices, and academia to develop improved processes and equipment. ManTech promotes 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, and industrial entities, 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 among the Navy ManTech Program Office, COEs, General Dynamics Electric Boat, Huntington Ingalls Industries – Newport News Shipbuilding, Program Executive Office (PEO) Submarines, and the PMS 450 Program Office have resulted in a focused ManTech initiative for VCS. To date, technology from 55 of the portfolio's approximately 134 projects have been implemented, or are in the process of being implemented, resulting in real acquisition cost savings of approximately $42.1M per hull, verified by our industrial partners and PMS 450.

The Navy ManTech Program is managed by the Office of Technology 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 Office of Technology is composed of transition-centric programs, including ManTech, Future Naval Capabilities, the Small Business Innovation Research / Small Business Technology Transfer, Navy Technology Transfer Program, and other transition initiatives.

The directors of the ManTech programs of the Army, Navy, Air Force, Defense Logistics Agency, and Missile Defense Agency coordinate their programs through the auspices of the congressionally-chartered Joint Defense Manufacturing Technology Panel (JDMTP) with representation from the Office of the Secretary of Defense, the Department of Commerce's National Institute of Standards and Technology, the Department of Energy, the Defense Advanced Research Projects Agency, 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 which was established by the 2011 National Defense Authorization Act 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 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 resources 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 the VIRGINIA Class submarine (VCS), COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class aircraft carrier, F-35 Lightning II, and CH-53K heavy lift helicopter.

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

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

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

Navy ManTech Investment Strategy

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

- **Transition** denotes that point at which the ManTech project is completed and the technology meets customer (Program Office / PEO / industry) criteria and goals for implementation.

- **Implementation** denotes the actual use of the ManTech results on the factory floor. (The resources for implementation are typically provided by entities other than ManTech including the Program Office / PEO 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 / PEO, 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 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 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.

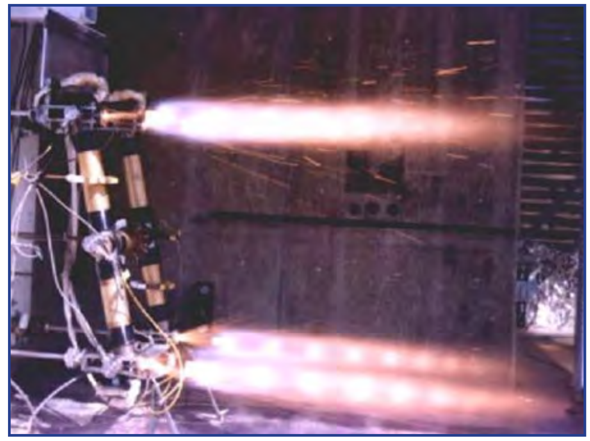
Semi-annual affordability assessments identify projected cost reduction / avoidance per project, as well as calculate an estimated total ownership cost savings per platform. These assessments, which are verified by industry and the relevant Program Offices / PEOs, provide critical information to ensure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

Navy ManTech Investment Strategy

While a 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: ManTech projects that support energetics 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. Projects develop 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 12.

RepTech: While the major emphasis of 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 13.



Development of Energetics Manufacturing for Primary Explosives. Courtesy of EMTC

Innovative Cold Spray Repair Technology for Ships. Courtesy of iMAST

Navy ManTech Execution

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

The COEs:

- Execute projects and manage project teams;
- Serve as a corporate expertise in technological areas;
- Collaborate with acquisition Program Offices / PEOs / 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.

Center for Naval Metalworking

The Center for Naval Metalworking (CNM) develops and deploys innovative metalworking and related manufacturing technologies to reduce the cost and time to build and repair key U.S. Navy ships and weapons platforms, while also collaborating with other relevant manufacturing industries. CNM utilizes a proven approach that blends the virtual center model with in-house technical expertise to ensure that project teams are comprised of the best providers from the industry to identify, develop, select, and execute 'metals-centric' projects that support ManTech objectives and transition to industry.

CNM is managed by Advanced Technology International (ATI) and partners with Edison Welding Institute (EWI), leveraging EWI's member-based organization that provides applied research, manufacturing support, and strategic services. CNM conducts projects that focus on metals and advanced metallic materials, metal-based composites, metal manufacturing processes (e.g., additive manufacturing), and joining techniques, coupled with process design control, advanced metrology, and inspection technologies.

CNM web site: http://www.navalmetalworking.org

Composites Manufacturing Technology Center

The Composites Manufacturing Technology Center (CMTC), established in 2000, is located in Summerville, SC, and is operated by Advanced Technology International (ATI). 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, CH-53K, and the F-35 Lightning II.

CMTC web site: http://cmtc.ati.org

Navy ManTech Execution

Electro-Optics Center

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

The EOC is a proud part of The Pennsylvania State University Applied Research Laboratory (ARL) which enables access to the researchers and scientists, state-of-the-art facilities, and leading-edge research at both the university and ARL. EOC staff, comprised primarily of former industry and DOD personnel, brings experience in exceeding sponsor and corporate expectations. Through the application of this 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

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.

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

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC), established in 1994 by ONR, is Navy-operated and located at the Naval Sea Systems Command's Naval Surface Warfare Center, Indian Head Explosive Ordnance Disposal Technology Division (NSWC IHEODTD), Indian Head, MD. NSWC IHEODTD serves as the focal point for the center and as a renowned leader in energetics and 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 and 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 web site: http://www.navsea.navy.mil/Home/WarfareCenters/NSWCIndianHeadEODTechnology/WhatWeDo/EMTC.aspx

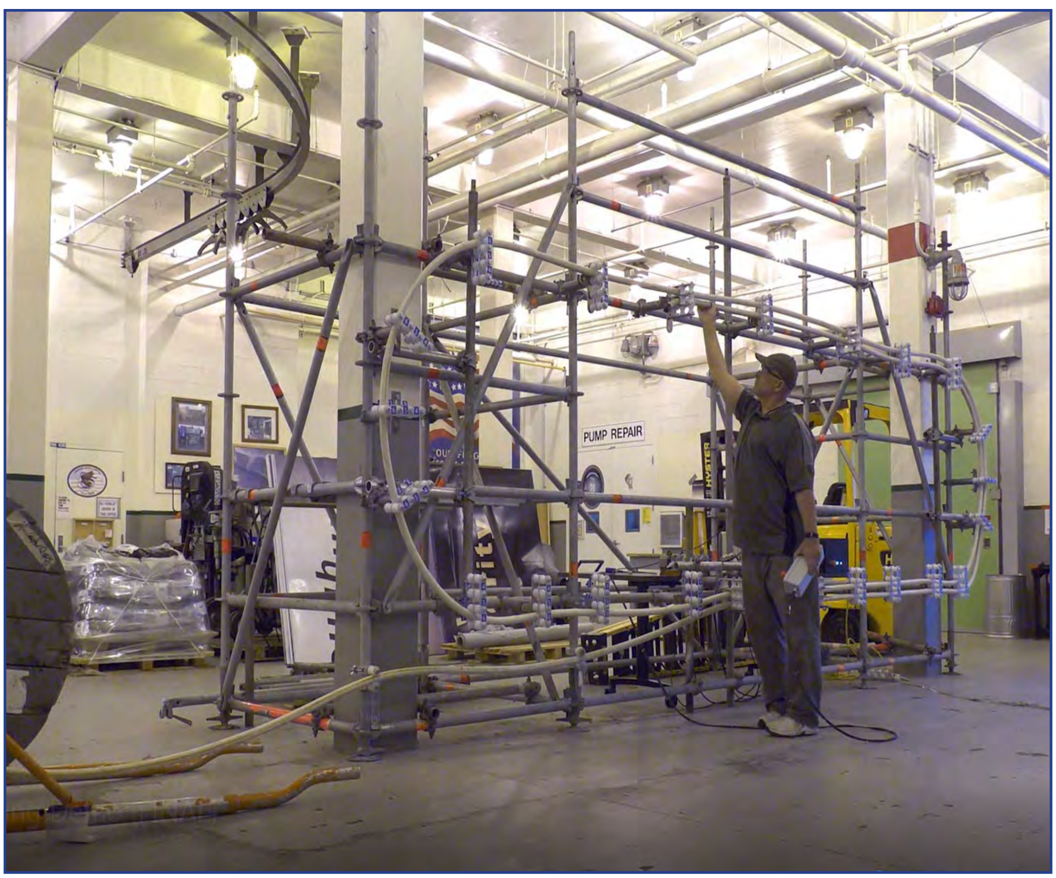
Navy ManTech Execution

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 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.

The Repair Technology (RepTech) program 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/content/institute-manufacturing-sustainment-technologies



Synchronized Cable Feeding System Expected to Reduce Cable Installation Cost.
Courtesy of iMAST

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 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 Advanced Technology International (ATI) since 2003. 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, and 3D product models to support production, and developing improved scheduling systems for new, aggressive build strategies.

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

Induction heating and straightening for ship panels will reduce rework.
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 https://www.onr.navy.mil/Science-Technology/Directorates/Transition/Manufacturing-ManTech. The Web site is a central source to access general information about program activities and participation, developments and events, and key points of contact. The site also offers links to the annual Navy ManTech Project Book, program success stories, as well as other publications.

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/DMC/

ShipTech

The event is a forum to exchange information on the manufacturing technology developments generated by Navy ManTech through its COEs, as well as the related initiatives conducted by the National Shipbuilding Research Program, industry, and academia. **ShipTech's** objective is to reduce acquisition and total ownership costs of naval ships while enhancing the competitiveness of the U.S. shipbuilding industry.

Project Book

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

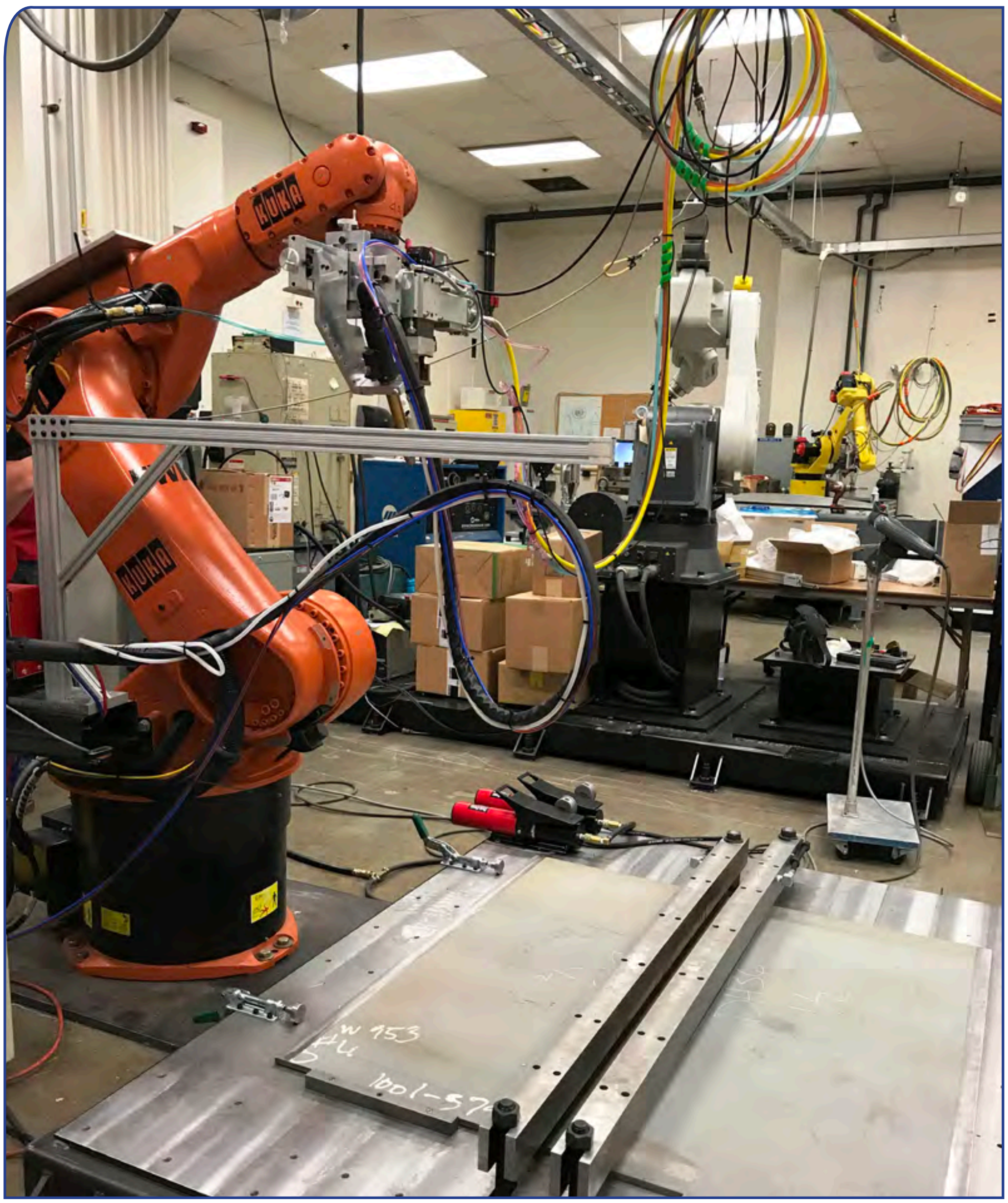
Centers of Excellence

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

Navy ManTech Technology Transfer

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

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

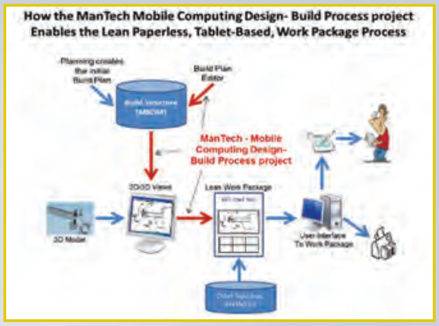


Hybrid Laser Arc Welding – Courtesy of Huntington Ingalls Industries - Ingalls Shipbuilding / NSAM

Navy ManTech – affordability improvements for key naval platforms: VIRGINIA Class submarine (VCS), COLUMBIA Class submarine (CLB), F-35 Lightning II, CVN 78 Class aircraft carrier, DDG 51 Class destroyer, and CH-53K heavy lift helicopter. Courtesy of PEO (Subs), PEO (JSF), PEO (Carriers), PEO (Ships), and PEO (A).

Navy ManTech Makes Significant Im

Recent projects demonstrate the Navy ManTech Program's significant im



Mobile Computing Design-Build Process Creates Lean Tablet-based Work Packages

The mobile computing tool creates lean, tablet-based work packages from the legacy VIRGINIA Class submarine (VCS) product model and offers an estimated cost savings of $367K per VCS and five-year cost savings of $3.7M. The tool allows users to create lower level work instructions up to 50 percent faster with significantly more details, setting the standard for how digital data feeds manufacturing.

Self-Locating, Self-Fixtured Method Optimizes Submarine Construction

Implementation of a more efficient way to fit and join submarine deck structures for the COLUMBIA Class submarine (CLB) and the VIRGINIA Payload Module (VPM) will result in estimated savings of $2.2M per CLB, $107K per VPM, and life-of-program savings for both CLB and VPM of more than $28M.

Retractable Bow Plane Improvements Offer VIRGINIA Class Submarine $300M in Life-Cycle Savings

Implementation of a reliable thermal spray coating for the VCS retractable bow plane system offers life-cycle savings of $9.6M per VCS based primarily on the labor savings for as many as 29 seal replacements over the life of each submarine, which equates to total VCS life-cycle cost savings of approximately $300M.

pact to Ship and Aircraft Affordability

pact to reduce acquisition and maintenance costs for ship and air platforms.

Ice Probe / Controller Reliably Detects Ice Buildup

The CH-53K Ice Detector System is a safe, reliable, and cost-effective ice probe / controller system that detects ice buildup on the CH-53K heavy lift helicopter in hovering and flying conditions, eliminates the radiation hazard of the legacy Strontium 90-based detector, and provides pilots with unambiguous feedback on icy weather conditions.

Automated and Rapid Seal Installation Provides F-35 with $120M in Cost Savings

Approximately $120M in cost savings have been identified for the F-35 Lightning II by implementing three technologies that optimize door and panel manufacturing and enable affordable fabrication of unique seal shapes by reducing labor, manufacturing defects, and production span time.

Improved Manufacturing Processes to Save Over $202M for F-35 Electro-Optical Targeting System

Implementation of manufacturing line improvements to the Electro-Optical Targeting System infrared focal-plane array and integrated Dewar cooler processes, executed via four Navy ManTech projects, will provide an estimated savings of more than $202M to the F-35 Program. Individual process improvements are integrated into the production line as they are qualified, maximizing cost savings and return on investment.

CVN 78 Class / Aircraft Carriers Projects

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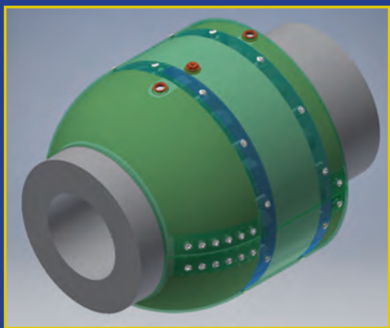
Composite Hybrid Rotating Coupling Covers to Provide Acquisition and Life-Cycle Cost Savings for Aircraft Carriers



PERIOD OF PERFORMANCE:
September 2014 to May 2018

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 378, PMS 312

TOTAL INVESTMENT:
$2,005,000

S2532 — Composite Hybrid Rotating Coupling Covers

Objective

Rotating Coupling Covers (RCC) enclose shaft flanges on waterborne shafting on aircraft carriers. The existing fairings are doubly curved copper-nickel with tight dimensional tolerances, which makes them difficult and expensive to fabricate. In addition, they have a history of leaking, as evidenced by extensive corrosion of the flanges. This Navy Manufacturing Technology, Composites Manufacturing Technology Center project replaced the metallic RCC with a composite RCC. The functions, shape, and arrangement of the individual components were determined during execution of the project, with a focus on optimizing manufacturing processes and reducing costs. As the primary structure, the composite shells of the RCCs were fabricated using methods including male molding with oven vacuum bag prepreg. A decoupled design was desired to eliminate the need for a watertight fairing seal.

Payoff

Offering both acquisition and life-cycle savings, the project is estimated to save up to $19M in total, resulting in a return on investment of 7:1. The fabrication approach will also reduce production time.

Implementation

This project will be demonstrated with PMS 312C funding on the earliest availability of a CVN 68 Class aircraft 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. Implementation is anticipated to occur in FY20.

Higher Deposition Submerged Arc Welding Processes Will Increase Productivity

S2595 — High Deposition Submerged Arc Welding for CVN 78 Class Aircraft Carriers

Objective

Compared to the previous class, CVN 78 Class aircraft carriers are designed with larger quantities of thicker and thinner plating. These changes have negatively impacted fabrication costs by increasing welding hours and distortion, respectively. To achieve ship class cost-reduction goals, Huntington Ingalls Industries - Newport News Shipbuilding (NNS) is modernizing its welding infrastructure to improve productivity. This project identified an advanced submerged arc welding (SAW) process variant capable of increasing process productivity while meeting NNS application requirements. It developed and recommended advanced commercial-off-the-shelf technologies capable of meeting unique U.S. Navy fabrication requirements. The project-developed recommendations will be used by NNS to acquire and implement new equipment that is capable of higher welding deposition rates while supporting CVN 78 fabrication demands.

In Phase 1, the team affirmed the legacy SAW performance using empirical methods that allowed NNS to establish technical, productivity, and application requirements for the new candidate processes. With many new technologies on the market, the team conducted an exhaustive literature survey to identify several high-potential candidates. The literature survey results were enhanced with empirical data and both data sets were used to evaluate the process and equipment against the requirements using normalization factors. Test plans were developed and conducted to evaluate the final candidate processes for productivity and robustness in the shipyard environment. A final candidate was recommended for Phase 2 activities. The initial business case was refined with new data to determine if the project was still economically feasible.

As part of Phase 2, the project team evaluated and quantified the performance of the down-selected candidate high deposition SAW process. The candidate process is undergoing additional shipyard evaluations to determine the robustness and technical feasibility of the process in a shipyard (application) environment.

Payoff

The business case has a projected return on investment of 0.73 to 0.57:1 ($1.9M to $2.4M per hull). However, this is an interim business case based on work currently underway. At the conclusion of the project, NNS will submit a final business case report that breaks down the collection of data and the process.

Implementation

Implementation will utilize a phased approach, where the most beneficial opportunities will be assigned higher priority and implemented first. The results of this ManTech project may be implemented in production of CVN hulls as early as the first quarter of FY19. However, the schedule for implementation activities is dependent on the project results.

PERIOD OF PERFORMANCE:
June 2015 to October 2018

PLATFORM:
CVN Class / Aircraft Carriers

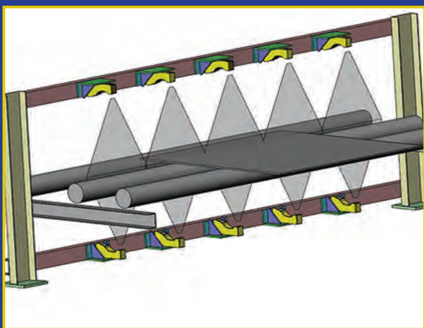
CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 378, 379

TOTAL MANTECH INVESTMENT:
$ $1,467,000

Implementing 3D Inspection of Steel Plates Will Save Shipbuilding Costs



PERIOD OF PERFORMANCE:
August 2014 to April 2018

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
NMC

POINT OF CONTACT:
Mr. Robert E. Akans
(814) 262-2349
akansr@ctc.com

STAKEHOLDER:
PMS 378, PMS 379

TOTAL MANTECH INVESTMENT:
$1,645,000

S2606 — Efficient Identification of Plate Defects

Objective

Steel plates used in the construction of CVN 78 Class aircraft carriers as well as other Navy vessels must be inspected for defects, such as scars and weld spatter, to meet surface requirements and ensure integrity. The defects are very difficult to find by visual inspection prior to painting; however, repairing them after painting and downstream installation results in a significant cost increase to complete the repairs. This project developed and implemented a defect detection system that will ensure quicker and more accurate defect detection on pre-painted steel plate surfaces than can be achieved with current visual inspection methods. The project created prototype detection system concepts, developed a final prototype, fabricated and installed the prototype at the industrial facility, and gathered data to assist in supporting full implementation.

Payoff

The expected five-year savings for this project are approximately $4.38M at Huntington Ingalls Industries - Newport News Shipbuilding (NNS) due to a reduction in rework and a positive schedule impact from earlier defect identification. The resulting technology, though focused on CVN 78 Class hulls, is applicable to all platforms and shipyards across the range of programs for Navy ships.

Implementation

Partial implementation of the system began in January 2018, and pilot testing and continued software development and tuning are ongoing. Artemis Vision, the integrator, is responsible for completing the required software revisions and reporting parameters post-project with the support of NNS and Structural Coatings. Upon completion of the revisions, NNS will pursue full implementation of the defect detection system, including the design, fabrication, and installation of a bottom-side laser system that will integrate into the current control system. The system is installed and will be used at Structural Coatings in Cofield, NC, to support NNS plate processing.

Induction Heating Will Straighten Deck and Bulkhead Panels and Reduce Rework

S2664 — Induction Straightening for CVN

Objective

Current CVN 78 Class aircraft carrier construction employs flame-straightening to straighten deck and bulkhead panels within required tolerances. Although effective, the process is time-consuming and allows for variability in application. It requires numerous application zones across the full area of the panel and often necessitates multiple treatments. Phase 1 of the project determined technical acceptability testing and is executing a test plan to develop induction-straightening parameters that do not adversely affect HSLA 65 material properties. Phase 2 will determine the effectiveness of the developed induction-heating parameters to straighten a representative mock-up of a ship structure.

Payoff

If the process is able to achieve a labor-reduction goal of 50 percent, Huntington Ingalls Industries - Newport News Shipbuilding (NNS) projects an estimated savings of $7.4M per CVN hull.

Implementation

The transition event for this project is the submission of a formal endorsement from NNS's CVN 79 Program Office to PMS 379, accompanied by the justifying business case analysis that has concurrence from NNS's cost and pricing department, and the completion of Phase 2 testing and evaluation activities. Successful completion of the testing and evaluation activities will verify that the process meets the expectations of the project team and stakeholders and is ready for implementation at NNS. Implementation is anticipated in the third quarter of FY19.

PERIOD OF PERFORMANCE:
June 2016 to August 2019

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 378, 379

TOTAL MANTECH INVESTMENT:
$ 2,006,000

Improved Affordability and Producibility for EMALS Components

PERIOD OF PERFORMANCE:
February 2016 to December 2019

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PMS 378, PEO (Carriers), NAVAIR PMA-251

TOTAL MANTECH INVESTMENT:
$540,000

S2686 — Electromagnetic Aircraft Launch System (EMALS) Armature Assembly Producibility Improvements

Objective

The armature assembly of the Electromagnetic Aircraft Launch System (EMALS) connects to the aircraft at the tow bar interface. Electromagnetic fields accelerate the armature assembly, providing the thrust needed to launch the aircraft. As the load transmission link between the EMALS and aircraft, the armature assembly is a Critical Safety Item, as are each of the components comprising the armature assembly. The acquisition cost of the armature assembly is a target for ManTech affordability investment. Many of the vendors supplying armature assembly components are sole-source. Sole-source supply of critical components creates technical, cost, and schedule risks. The current acquisition lead time for one armature assembly is 36 months. The five armature assemblies fabricated for CVN 78 were delivered a year after the scheduled in-yard date.

The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) project is to reduce the cost and lead time associated with acquisition of the EMALS armature assembly and is focusing on one high cost component, the aft bogey. The estimated acquisition cost of the aft bogey is $215K. At approximately 23 percent of the total armature cost, reducing the cost of the aft bogey is a logical starting point to reduce the cost of the armature assembly.

Payoff

The iMAST obtained a quote for $175K for a 4,000-pound billet of Custom 465 stainless steel – large enough to machine an aft bogey. iMAST identified a forging house and received quotes for Custom 465 stainless steel forgings of $93K each. This will reduce raw material cost by approximately $80K per aft bogey. Starting with a forging weighing approximately 500 lbs. (vice a 4,000-pound billet) will also reduce machining costs. Cost reduction of other armature assembly parts will further improve the return on investment and contribute to a successful project.

Implementation

Implementation hinges on successful cost reduction of the EMALS aft bogey. Implementation requirements are straightforward – material requirements, incoming material inspection requirements, and part acceptance criteria already exist for this component. Potential vendors will adhere to all relevant material and first article inspection requirements. iMAST will work with vendors to ensure that the necessary vendor certifications and registrations are in place. The implementation target date is early 2026 (CVN 81).

Electronic System for Staged Shipboard Equipment Provides Real-time Information and On-demand Support

M2726 — Geospatial Component Location, Identification and Condition (GeoCLIC)

Objective

Geospatial Component Location, Identification and Condition (GeoCLIC) is a CVN 78 Class aircraft carrier (CVN) and VIRGINIA Class submarine (VCS) project which addressed the needs of both the Navy and Huntington Ingalls Industries – Newport News Shipbuilding (NNS) by replacing the current paper-based manual process with a more efficient electronic location process that saves time and money. Data provided by the system supplements the existing inventory location information with the necessary level of detail to efficiently identify components. The system's process improvements complement existing databases with tracking and status reporting completed in the field using location / identification hardware and software.

Payoff

The ability to work remotely with real-time information and electronic on-demand support information significantly increases efficiency and improves record-keeping accuracy. This project demonstrated the use of radio frequency identification (RFID) and augmented reality technologies to greatly improve the preventive maintenance work required as part of VCS prime contracts. The projected cost savings are $2.6M over five years per CVN hull and $342K over two years per VCS hull. Savings are based on developing an infrastructure of GPS / grid location information embedded in RFID tags and readers located throughout the yard that reduce the search time for components requiring preventive maintenance.

Implementation

NNS developed new process documents and revised existing supporting work instructions. Training documents were created to facilitate process standardization and to optimize the use of the app and RFID tags. Installation of 1,000 RFID tags was completed in August 2018 and receipt of 5,000 RFID tags is anticipated in before late-October 2018. Nine of the 11 total tablets with the GeoCLIC app will be deployed by late-October 2018. Additional RFID hardware (readers / antennas) will be installed in a phased approach to provide greater coverage in the production area. The remaining implementation items required to fully integrate the project objectives and processes are minimal, and NNS success is not solely dependent on full implementation to start achieving the benefits from the project.

PERIOD OF PERFORMANCE:
May 2017 to March 2018

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 378, 379, PMS 450
PEO (Carriers)

TOTAL MANTECH INVESTMENT:
$405,000

Industrial Modeling and Simulation to Evaluate Current Factory Configurations and New Facility Designs

PERIOD OF PERFORMANCE:
December 2016 to June 2019

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PMS 379

TOTAL MANTECH INVESTMENT:
$624,000

S2727— Advanced Steel Production Facility – Industrial Modeling and Simulation

Objective

The Institute for Manufacturing and Sustainment Technologies (iMAST) will develop stochastic discrete event simulation models of the entire fabrication process for the products created by Huntington Ingallls Industries - Newport News Shipbuilding's (NNS') current and future state Steel Production Facility. The models will provide a means for NNS to assess alternatives for modifications to the current factory configuration as well as new facility design to obtain the productivity increases needed to support accelerated production schedules and cost-reduction initiatives for CVN construction.

NNS is proposing a radical shift in manufacturing within the Advanced Steel Production Facility (ASPF). The models will enable productivity changes to be assessed globally and at the station level, allowing productivity variations to be determined and technology gaps to be identified. Alternative equipment, process flow configurations, and new stations will be "modeled." Modules representing these stations will be inserted into the model to iteratively evaluate alternative scenarios which will, in turn, facilitate capital investment decision making.

Payoff

The following EROM savings (based on the ASPF model only) may be obtained. First, products that were removed from the legacy panel line due to weight, depth, or access may be assembled on a new production line. This effort is estimated at approximately 400K labor-hours per hull. If this can be fabricated using an assembly line method, it is estimated that a 40-percent reduction can be achieved (approximately $17.2M savings per CVN). Second, products assembled on the panel line will be assembled, joined, and undergo early outfitting more effectively. NNS estimates that an increase in productivity can be achieved resulting in an approximately 20-percent savings. With 1.8M labor hours assigned per hull to ASPF for panel line completion, this equates to a savings of 360K labor-hours per hull (approximately $38.6M per CVN).

Implementation

Upon completion of this project and acceptance of the technology and associated business case by the acquisition Program Office (PMS 379), the models and all associated software applications and source code will be transitioned to NNS. The technology will be implemented at NNS through use in follow-on research and development efforts expected to be funded to support the ASPF concept.

Newport News Shipbuilding Will Leverage ManTech Tool to Connect Digital Thread

S2759 — Digital Thread Shipbuilder-Supplier Interface

Objective

Acquisition of shipboard components is entirely based on 'paper' purchase orders. Huntington Ingalls Industries - Newport News Shipbuilding (NNS) provides suppliers with 2D fabrication drawings that are developed from 3D component models. Suppliers use the 2D drawings to create their own 3D component models to produce parts using computer numerical control machines. Design and manufacturing collaboration during supplier contract execution is based on traditional spreadsheets, emails, and conference calls. Purchase orders are clouded with requirement noise relying on the supplier to determine what is and what is not required. With this complexity and overabundance of information comes the inherent risk of supplier delays and quality failures that can have a tremendous impact on cost, quality, and schedule. In addition, shipyard quality inspection typically takes place after manufacturing and production are complete, eliminating any possibility of in-process corrections. Shipboard construction installation and operation issues are discovered long after the supplier has delivered the product, resulting in rework and schedule delays.

The Digital Thread Shipbuilding – Supplier Interface effort will incorporate NNS's supply base into the company's digital shipbuilding strategy by connecting the 'digital thread' from design through production / fabrication, assembly, test, inspection, integration, and installation / operation. In addition, the digital information produced by NNS will need to be consumable downstream by fleet provisioning and sustainment activities. The project will help the supply base improve first-time quality, cycle times, schedule performance, and supplier readiness, which will lead to cost savings for the company and the Navy. When a part number is created in the Parts Catalog System, engineering will use computer-aided logic to assign requirements to help avoid human error and reduce the learning curve. The requirements applied will be clear, concise, and specific to the item, component, or assembly being purchased.

Payoff

The project will simplify technical data packages, produce 3D design disclosures, and establish a secure exchange medium to enable efficient two-way transfer of data with suppliers. Once implemented, the process improvement could save an estimated $10.2M per CVN 78 Class aircraft carrier.

Implementation

NNS plans to deploy the solution in its target environment after initial acceptance tests are complete and will engage affected individuals, groups, and organizations to ensure the solution satisfies documented needs and expectations. Implementation into a production environment will start in the third quarter of FY20 on CVN 80.

PERIOD OF PERFORMANCE:
February 2018 to March 2020

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 379

TOTAL MANTECH INVESTMENT:
$1,771,000

Newport News Shipbuilding Developing New Process to Resolve and Capture Growth Work

PERIOD OF PERFORMANCE:
March 2018 to September 2019

PLATFORM:
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 379

TOTAL MANTECH INVESTMENT:
$602,000

S2762 — Digital Problem Resolution

Objective

Huntington Ingalls Industries - Newport News Shipbuilding (NNS) processes nearly all un-scoped work during an execution the same way. Worker error, vendor error, material condition reports, and growth (unplanned) work are all resolved using one system, the Inspection Report System. The Inspection Report System is not effective at separating and identifying growth work, which can be some of the costliest work performed during the execution phase of a program.

Growth work includes repair activities not identified and, therefore, not budgeted for during planning. Growth work associated with carrier programs is inconsistent and causes major disruptions to cost and schedule goals. Savings could multiply when shipyards share knowledge and best practice solutions. NNS is developing a process that will reduce both immediate and future costs associated with growth work.

The Digital Problem Resolution effort will develop a process for CVN to capture and retain growth work items using digital information capture technologies. It will create a knowledge base to store identified resolutions for each growth work item. Engineering and planning personnel will contribute growth work resolutions, as best practice solutions, to the knowledge base. NNS will develop processes to exploit the laser-scanning solutions developed under the ManTech CVN Reality Capture project to increase the fidelity of applicable growth work resolutions. Additionally, NNS will evaluate other forms of digital capture technologies, including digital photographs and digital videos to identify an appropriate level of fidelity required for specific resolutions. The project will develop a process that digitally captures growth work items for use and evaluation by problem resolution teams from in-service carrier (ISC) and new construction (NC) aircraft carrier contracts.

Payoff

The project will improve work time (hours spent by personnel), response time (hours until a resolution is approved), and the incorporation (coverted into planned work) rate of growth work. By emphasizing digital media when capturing growth work, cost savings will multiply downstream by eliminating time to review and confirm conditions at each stage. Once implemented, the process improvements are estimated to provide five-year savings of $3.3M for the CVN 78 Class aircraft carrier across ISC, NC, and Refueling and Complex Overhaul work.

Implementation

NNS plans to deploy the solution in its target environment after initial acceptance tests are complete and will engage affected individuals, groups, and organizations to ensure the solution satisfies documented needs and expectations. Implementation into a production environment is projected for the second quarter of FY20 on CVN 79.

DDG 51Class Projects

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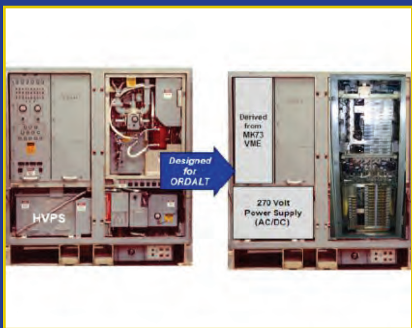
MK-99 CW Illuminator Transmitter Upgrade Meets Navy's Need for Reliable, Affordable Solid-State Replacement for Tube-Based System



PERIOD OF PERFORMANCE:
June 2012 to January 2018

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
EMPF

POINT OF CONTACT:
Mr. Thomas Gill
(610) 362-1200 x215
tgill@aciusa.org

STAKEHOLDER:
PMS 500, LPD 17, IWS 1.0

TOTAL MANTECH INVESTMENT:
$7,435,000

S2385 — Continuous Wave Illuminator Transmitter Upgrade

Objective

The radar transmitter used in the Aegis MK 99 fire control system (FCS) operates in conjunction with other components to provide radiated energy for semi-active homing of the assigned missile. The transmitter contains equipment to generate and amplify the stable continuous wave (CW) microwave signal to the required output power level. The current design for this has an unacceptably low mean time between critical failure (MTBCF) and has adversely affected both combat readiness and support costs for the DDG 51 Class destroyers.

The objective of this ManTech project was threefold. The first objective was 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 was to develop and implement new manufacturing technologies in critical subassemblies to reduce system cost. The third objective was to ensure continued production cost affordability to the Navy.

Payoff

Analysis of the design associated with this ManTech effort concluded that the backfit-compatible GaN-based MK 99 transmitter upgrade will result in a 50-percent reduction in acquisition cost ($2M target) and a greater than 39 times improvement in the mean time between critical failure (MTBCF). The open architecture accommodates the easy spiral insertion of the evolving Solid-State Power Amplifier (SSPA) and power supply technology, and the open software and hardware architecture supports rapid technology refresh and increased performance. The open architecture supports future cutting-edge, commercial-off-the-shelf (COTS) technologies, including analog devices, processors, and accelerators. 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 was to 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. However, due to the combination of issues experienced during testing, exhaustion of funding, and the end of the project period of performance, design verification testing was not completed in order to demonstrate operational success of the upgraded CW Illuminator Transmitter. The design verification testing will be included as part of the follow-on NAVSEA contract with Raytheon and IWS-1, including the separately funded Qualification Tests and Limited Rate Initial Production phases of the program.

Improving the Yield of SiC High-Efficiency Power Switches

S2489 — SiC High-Efficiency Power Switches Wafer Process Improvement

Objective

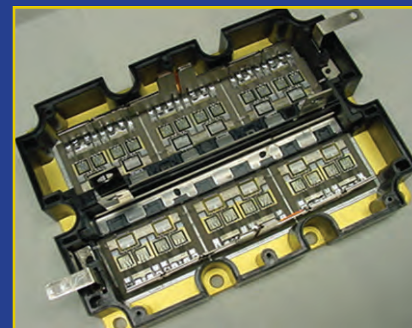
Navy platforms continue to improve their performance and capabilities by insertion of new technologies, which ultimately require additional energy. High-efficiency power switching devices provide higher energy densities, thereby providing additional power without requiring ever larger footprints. Under this five-year effort, the production yield of 6.5kV and 10kV silicon carbide (SiC) metal-oxide-semiconductor field-effect transistors (MOSFET) was increased by transitioning from production on 100mm SiC wafers to 150mm wafers and optimizing the design. Eight design iterations were completed under this effort to optimize doping levels and dimensions of critical features of the device. Device yield has improved from 20 percent to greater than 50 percent, and the acceptable amount of power that can be switched is doubled.

Payoff

There are many current and future Navy platforms that will be able to take advantage of this technology. At the start of this project, switching costs were in the range of $100 per amp. Costs have been reduced to approximately $20 per amp. Navy personnel are engaged to estimate the number of switching devices the Navy will consume in the near future once this technology is transitioned to a commercial product and to identify platforms that will be first users of this technology.

Implementation

Wolfspeed, a Cree company, has demonstrated the ability to implement its technology into a commercial device by commercializing 1.2kV SiC metal-oxide-semiconductor field-effect transistors (MOSFETs). Wolfspeed continually performs market research to determine the power needs of both the commercial and Department of Defense sectors. Using previous trends in power requirements, Wolfspeed believes the market will require a commercial product in 18-36 months after project completion. At that time, Wolfspeed will lock down a design with specific power ratings and begin the transition from prototypes to commercial products. In preparation for that transition, Wolfspeed has successfully completed JEDEC Solid State Technology Association qualification testing of 10kV SiC MOSFETs on 100mm 4HN-SiC wafers and is currently carrying out JEDEC qualification testing of 6.5kV SiC MOSFETs on 150mm 4HN-SiC wafers under the Department of Energy PowerAmerica manufacturing program.



PERIOD OF PERFORMANCE:
September 2013 to December 2018

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

STAKEHOLDER:
PMS 400D, PMS 500, PMS 378

TOTAL MANTECH INVESTMENT:
$5,400,000

Automation of Repetitive Tasks and Flexible Connector Adapter Production

PERIOD OF PERFORMANCE:
February 2017 to November 2019

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

STAKEHOLDER:
PMS 400D, PMS 500

TOTAL MANTECH INVESTMENT:
$2,625,000

S2626 — Test Adapter Efficiency Improvement

Objective

This project builds on the theme that the complexity of electrical and optical connections in ships leads to high installation and maintenance costs. In addition to simplifying cabling designs, reducing the cost of complex cable installation and testing is a way to improve acquisition (material) and life-cycle (reliability and maintenance) costs. Previous Navy ManTech and National Shipbuilding Research Program projects have provided some methodology toward decreasing cable testing costs. Using the results of the previous projects, this project will validate methods that reduce the cost of automatic cable testing and provide electrical, radio frequency (RF), and fiber optic tests at the Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) Pascagoula shipyard.

The project is being executed by four organizations: the Penn State Electro-Optics Center, Ingalls (providing industrial engineering and integrating the project results), DIT-MCO International (production supplier of the Integrated Link Test System), and Ultra Communications (manufacturer of optical transceivers and hardware).

Payoff

The overall project is estimated to result in savings in excess of $700K per year at the shipyard. Individual task savings come from reductions in test execution time, data transcription and hookup errors, and lead times for adapter connectors; increased flexibility with the capability of producing test adapter connectors on site; and the introduction of new test technology.

Implementation

Transition opportunities for this project include process changes related to testing, and possible engineering design changes related to cable simplification and RF cable sustainment. Process changes are anticipated to be implemented on DDG 125 in FY20. Changes impacting the engineering design will be considered for implementation on a ship in FY20. Once the ManTech project achieves cost-reduction results relating to a specific task, the transition of improvements into each additional platform will take from three to six months, depending on the availability of resources and the relevance of each process improvement. Project results may also be implemented on the LHA and LPD platforms.

Improving Manual Welding through Improved Visualization

S2628 — Augmented Visualization for Manual Welding

Objective

Welding is the predominant joining method used in the assembly of ship structures, and each shipyard has hundreds of certified manual welders who are responsible for delivering quality welds at a reasonable speed. Even with improvements in auto-darkening weld shades, it remains a difficult art to see the weld space prior to the weld arc being struck and to allow human eyes to adjust to lower levels of light once the arc is off. The learning curve to become a proficient welder is long, and many welders give up before reaching a desired level of proficiency.

The project is developing and demonstrating a new visualization tool for manual welding, using head-mounted cameras and stereo displays. The newly built devices will be evaluated at Huntington Ingalls Industries – Ingalls Shipyard for improvements in quality, speed, and learning curve, against measured baseline tests from auto-darkening weld helmets.

In addition to solving problems with eye strain, learning curve, and quality, the development of a heads-up camera display for manual welding is the first step in delivering the capability for augmented reality in hot work applications at the shipyard.

Payoff

Improved visualization in manual welding seeks cost savings from three unique positions: improvement in "arc time" productivity, shortening the learning curve to proficiency, and reduction in rework. If augmented visualization has a 10 percent benefit for just 30 percent of the welders, a single shipyard with 1,000 welding positions could save over $4M annually. The addition of augmented reality to the welding display could someday substantiate even higher savings.

Implementation

The primary transition platform for this project is the DDG 51 Class destroyer. A business case for cost savings will be weighed against the cost of bringing the technology to production at an appropriate annual volume for the market. If shown to be successful, implementation will extend to other Department of Defense and dual-use applications.

PERIOD OF PERFORMANCE:
February 2017 to April 2019

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$2,097,000

Adapting Existing Robotic Welding Systems Will Save Costs to Fabricate Large, Complex Structures

PERIOD OF PERFORMANCE:
May 2015 to September 2018

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NMC

POINT OF CONTACT:
Mr. Robert E. Akans
(814) 262-2349
akansr@ctc.com

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$1,447,000

S2636 — Robotic Welding of Complex Structures

Objective

Traditional manual welding processes used to fabricate large complex ship structures are labor intensive and ergonomically challenging. The Navy Metalworking Center led a ManTech Integrated Project Team (IPT) to develop a system to semi-autonomously define weld paths based on varying complex structure geometries that will then utilize existing welding robots to execute weld operations. The process utilizes feature recognition to define weld paths while not requiring the use of high-level programming skill sets. Once defined, a parametric weld program automatically programs robot manipulation to perform the weldment. The IPT demonstrated a prototype system that integrates the necessary hardware and software to semi-autonomously locate the weld seam, position and orient the welding head, and execute a suitable weld.

Payoff

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

Implementation

Initial trials demonstrated the feasibility of this approach; however, shortcomings in the existing robot arrangements were encountered that dictated the need to conduct further assessments of the PVLS cell and existing robotic arms to define proper modifications for full-scale implementation. Full-scale implementation will occur once the PVLS cell has been fully modified with the required hardware and software and personnel at BIW have been fully trained and approved to use the cell. The anticipated implementation timeline is the third quarter of FY19, with initial implementation (low-scale utilization) occurring in the second quarter of FY19.

Lifting Strategy Improvements Offer $10.3M in Savings

S2652 — Optimized Lifting and Handling

Objective

The lifting and handling processes, procedures, and equipment utilized by Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) had evolved to address the specific requirements of each step, without regard for the entire process as a whole. Controlling documentation for each organization was not coordinated, was inconsistently applied, did not clearly delineate roles and responsibilities, and frequently conflicted. As a result, the cost for the DDG 51 Class destroyer rose sharply as ship complexity and process steps increased.

The Optimized Lifting and Handling project studied the lifting and handling processes across all Ingalls organizations and platforms to understand the key cost drivers that needed to be addressed to reduce costs. The project developed organizational and technical solutions that targeted the cost drivers and developed a Decision Matrix Guide for lifting and handling. The guide provides coordinated guidance and lessons learned and establishes methods of lifting and handling units that are optimized for the entire construction and erection process. The project addressed deficiencies with the lifting strategy to optimize the shipyard-wide moving and maneuvering of production material and units.

The project surveyed all areas of the shipyard and found two major cost drivers: the use of temporary structures and padeyes. As a result, the implemented process improvements reduced the use and consequent costs associated with these cost elements. Ingalls applied the Decision Matrix Guide as it vetted each new concept for feasibility and final disposition. Another key finding was the innovative insertion of permanent lifting jug points, which was approved as a new ship design element.

Payoff

The implemented technologies and processes reduce the costs associated with lifting and handling, which translates into a potential cost savings of $778K per DDG hull. More specifically, the savings associated with this effort will have additional benefits for other Ingalls' platforms and have five-year savings of nearly $10.3M across Ingalls-built U.S. Navy and U.S. Coast Guard platforms.

Implementation

Ingalls updated outstanding process documents and trained operations and engineering personnel to accurately utilize and maintain files for lifting and handling. Ingalls initiated and approved all changes to the current process documentation, and subsequently supervised the necessary process-user training. Implementation into a production environment started during the second quarter of FY18 on DDG 123.

PERIOD OF PERFORMANCE:
March 2016 to March 2018

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$801,000

Mechanized Unit Construction Process to Provide Annual Savings at Ingalls

PERIOD OF PERFORMANCE:
January 2016 to December 2017

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NMC

POINT OF CONTACT:
Mr. Robert E. Akans
(814) 262-2349
akansr@ctc.com

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$1,327,000

S2690 — Unit Family Construction Optimization

Objective

The Navy Metalworking Center led a Navy ManTech Integrated Project Team (IPT) to improve unit assembly, pre-outfitting, and kitting of components within the Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls) unit construction areas. Technologies developed will support a work cell approach to unit construction, resulting in fewer costly unit moves during the module construction process. Specifically, the team investigated modular unit fixturing to improve access and efficient leveling; deployable cranes for efficient material placement; utility line control management to increase access and utilization and to reduce safety concerns; and laser projection technologies to improve fit-up operations. In addition, upstream and downstream process areas, such as the Outfitting Hall and outdoor unit construction, were evaluated and could benefit from the solutions developed by this project. The down-selected concept(s) were demonstrated at Ingalls on unit assemblies to support full-scale implementation. Solutions developed as a result of this project supplement Ingalls' shipyard modernization plans.

Payoff

Implementation of manufacturing technology solutions to support construction of unit assemblies is estimated to produce an annual savings of $2.1M across all platforms currently constructed at Ingalls (DDG, LHA, LPD, and NSC) as well as future platforms. The total projected five-year process savings for all hulls is $10.3M

Implementation

Implementation began in July 2017 with "picture frame" unit fixtures being utilized in production of DDG 51 Class hulls. The implementation of other technologies continued into FY18 and supported the construction of all ship classes at Ingalls.

Increasing Productivity and Reducing Distortion by Employing Hybrid Laser Arc Welding

S2697 — HLAW Process Verification and Implementation for Ship Production

PERIOD OF PERFORMANCE:
December 2016 to March 2019

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D, PEO (Ships)

TOTAL MANTECH INVESTMENT:
$2,366,000

Objective

Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls) is introducing a new panel line to improve productivity in ship manufacturing. A review of joining processes used in commercial shipbuilding worldwide identified that Hybrid Laser Arc Welding (HLAW) can reduce the welding heat input used to join metals, thus minimizing distortion and therefore rework cost. Ingalls is procuring the capability to use HLAW in the panel line and understands that its processes must be characterized and accepted by NAVSEA for shipbuilding applications. Ingalls has had extensive collaboration with NAVSEA and has approval of the HLAW process qualification and certification test plan, supporting post-project implementation. The HLAW project has two phases, where in Phase 1 the Edison Welding Institute (EWI) developed HLAW process parameters and the team evaluated the resultant weld quality. Now in Phase 2, the HLAW weldments and the currently qualified baseline submerged arc welding process, a similar mechanized welding process, are undergoing fatigue and dynamic-load testing. Ingalls will use the EWI-developed parameters on the installed Ingalls HLAW panel line and validate weld quality through testing.

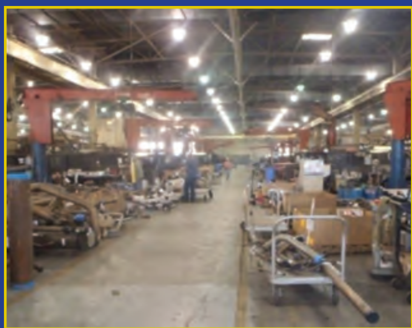
Payoff

Based on a project cost of $2.3M and implementation costs of $200K for a total cost of $2.5M, the savings from five DDG 51 (one per year for five years) class hulls equates to a return on investment (ROI) of 2.7:1. If other hulls and anticipated future ships are included in the ROI, the business case becomes stronger, (ROI of 8.1). LHA-8 and NSC are poised to take full advantage of HLAW single-sided welding.

Implementation

The process and system technology that will be developed and refined under this project is expected to be implemented at Ingalls and is directly applicable to other major shipyards supporting the Department of Defense. The project has been structured to provide all of the necessary data and information after project completion, to make a clear decision concerning implementation. Ingalls is determined to invest in the latest HLAW technology to address thin panel ship construction issues for hull quality control and production cost efficiency. Implementation is anticipated in the second quarter of FY19.

Ingalls Shipbuilding Works to Streamline Its Methodology for Short-Term Tactical Planning



PERIOD OF PERFORMANCE:
February 2017 to January 2019

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$581,000

S2700 — Tactical Information Planning System

Objective

Front-line foremen, which are responsible for the safety, quality, cost, and schedule performance of their crew, have more impact on production than any other member of Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) management. Their most laborious task is planning, progressing, and projecting their crew's work responsibilities through a two-week (short-term schedule) window for the DDG 51 platform. Typically, these activities are performed away from the production area and their crew. These critical, time-consuming tasks constrict the ability to manage people, issues, and quality. The foremen are key to optimizing productivity, as they draw on their extensive experience for solutions to most of the problems that crews face on a daily basis.

The Tactical Information Planning System (TIPS) project is developing a digital process that will increase the efficiency of front-line foremen. Ingalls is improving the work package decision-making process to enhance short-term resource planning activities. Ingalls anticipates an additional benefit of increased use and utility of mobility applications at the shop floor and deck plate levels. Mobile work capability is critical to future efficiency improvements in this area. The project team will consolidate critical information for the foremen from the systems of record in scheduling, engineering change, material, shop status and capacity, job planning, certifications, and personnel availability. The consolidation will enable efficiencies that allow the foremen to manage the completion of jobs faster while reducing work stoppages and rework.

The project is being conducted in two phases. Phase 1 assessed the present system and developed a high-level design for a new system that streamlines numerous administrative tasks necessary to achieve short-term scheduling and work assignment. Phase 2 is developing the systems / processes identified in the first phase and pilot testing those systems in the pipe shop.

Payoff

Once implemented, Ingalls anticipates the TIPS tool / system will provide foremen with vital work status in a more expedited fashion, resulting in labor savings that translate into a potential cost savings of $1.28M per DDG 51 hull. The team expects the savings associated with this effort will have additional benefits for other platforms and have a five-year savings of over $20.5M across the Ingalls-built U.S. Navy and U.S. Coast Guard platforms.

Implementation

The system will be proven and upgraded as needed with a pilot effort. The pilot will enhance the system practicality and measure process time improvement. An implementation plan for the system will be developed. Implementation into a production environment is targeted for the second quarter of FY19 on DDG 125.

Digital Thread Will Optimize Ingalls' Paint Management for DDG 51

S2701 — Digital Paint Tool and Process Optimization

Objective

Painting in the shipyard is a major undertaking, as almost every part of a ship will go through some degree of painting during construction. Specifically designated, constrained areas in the shipyard are dedicated to performing major paintwork. This limitation, coupled with the requirement to paint most parts, can often create a bottleneck for the rest of the construction processes taking place both before and after paint. At the core of this issue is the ability of the upstream engineering and planning organizations to provide the best data to the painters. Currently the paint data for engineering and planning is stored in several different places, in multiple disparate databases, and the data format / terminology varies across each ship program. This construction discipline is ripe for change: the paint 'metadata' needs to be standardized across all ship platforms, accessible as it changes, easy to maintain, and intuitive in its user interfaces and data presentation.

The Digital Paint Tool and Process Optimization project analyzed the current paint process and data to develop an optimized and consolidated method of generating, maintaining, and executing paint data for the DDG 51 Class destroyer. This system will create a unified data tool for paint data management, thus reducing labor costs through increased process efficiency and reduced rework. The digital paint tool will leverage this new paint data epoch by creating a central data management tool instead of the current multiple federated database method. The dynamic nature of the tool will allow upstream users to quickly modify, query, and provide an unprecedented ability to work with their data.

The project is being conducted in two phases at Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls). Phase 1 consisted of analysis, documentation, and process development tasks to understand the current paint process and data. Phase 2 is configuring, testing, and validating the digital paint tool to support the modified process developed in Phase 1. The focus is on end-user engagement in testing and validation to achieve the business goals.

Payoff

Once accepted, the scripted automation will be distributed to personnel extracting details for production use. This effort will reduce labor hours required to provide instruction artifacts for fabrication, which translates into a potential cost savings of $349K per DDG hull. Ingalls expects the tool to provide benefits for other platforms, resulting in estimated five-year savings of over $2.9M across the Ingalls-built U.S. Navy and U.S. Coast Guard platforms.

Implementation

The tool will undergo a series of trials to validate that the paint data is captured, managed, and delivered with its integrity preserved. In order to evaluate the tool's impact on efficiency and quality, metrics will be collected in accordance with the effectiveness evaluation criteria. Upon successful completion, testing, and the acceptance of the technology by Ingalls management, the results will be implemented on DDG 125 in the third quarter of FY19.

PERIOD OF PERFORMANCE:
January 2017 to May 2019

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$854,000

New Surface Ship Deck Material and Installation Process

PERIOD OF PERFORMANCE:
July 2018 to June 2019 (CMTC)
January 2017 to September 2018 (iMAST)

PLATFORM:
DDG 51
CVN Class / Aircraft Carriers

CENTER OF EXCELLENCE:
CMTC
iMAST

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D, PMS 500, PMS 379

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

S2723-A-B-1 — False Deck Panel Improvement Phase 1

Objective

The Arleigh Burke DDG 51 Class guided missile destroyer and both the Ford and Nimitz Class aircraft carriers require a false deck covering throughout their electronic spaces, where inspection and access to electrical and heating, ventilating, and air conditioning systems are necessary. The current composite decking is a structural sandwich panel with a 3/16-inch honeycomb core, faced with two plies of glass fiber reinforced plastic, and covered on both upper and lower surfaces with a wear surface. To ensure a watertight seal, the panels require a multi-step edge treatment around the perimeter, and on the DDGs when cut to fit around objects such as pipes, equipment, and furnishings during installation. The process of cutting and sealing the edges is highly labor-intensive. Additionally, the wear surface is prone to cracking, chipping, and delaminating in service. To meet cost-reduction targets and to improve the supply base, General Dynamics Bath Iron Works, Huntington Ingalls Industries – Newport News Shipbuilding, and Huntington Ingalls Industries – Ingalls Shipbuilding are evaluating alternative panel solutions.

The objectives are to develop a common material architecture that meets the requirements of both platforms in order to optimize efficiencies of scale, increase the potential supply base, eliminate edge preparation work, and generally reduce the costs of acquisition and installation, while maintaining or improving performance requirements.

Payoff

Projected cost reductions will result through increased productivity and throughput effected by eliminating time for cutting and edge treatment steps. Moving all installation activities to the ship should reduce panel fabrication time by as much as 75 percent (DDGs). Expected benefits include streamlining the installation process and reduction of maintenance burden on the ship's crew, which will translate into lower installation and sustainment costs. The total savings for 12 DDG hulls and three CVN hulls is $6.4M. The five-year return on investment is 2.12:1, and is expected to improve when the project results are applied to other classes of ships and back-fit onto the in-service fleet.

Implementation

NAVSEA will develop a Military Performance Specification document that will define material and performance characteristics requirements for all U.S. Navy surface ships. This project will work collaboratively with NAVSEA to ensure the proposed false deck panel alternatives meet acceptance requirements and constitute a viable solution to support false deck development and ship integration. Additionally, a full-scale prototype will be demonstrated for both DDG 51 and CVN. Implementation is anticipated to occur in production in early 2019.

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

Evaluating Non-destructive Testing Methods for Welds as Alternatives for Soap Bubble Leak Detection

M2729 — Advanced Leak Detection Methods

Objective

This DDG 51 Class destroyer project evaluated candidate non-destructive testing methods to replace the legacy soap and bubble leak detection inspection of weld joints. The improvement will provide a new inspection technology that removes the manual application of soap and water to the weld joints. Open and closed trials using acoustic ultrasound, eddy current, and soap bubble inspection processes were conducted to compare the inspection process performance in laboratory and shipyard environments. Acoustic ultrasound system UL 101 by CTRL Systems was determined to be the most promising replacement.

Payoff

This project determined the applicability of technology to the shipbuilding industry and developed a new acoustic ultrasound inspection procedure. Where applicable, the project results reduce the current amount of time it takes to perform weld inspection leak tests with acoustic ultrasound inspection versus the legacy soap bubble leak inspection method. This technology and process, once implemented, could potentially save an estimated $605K over five years across the DDG 51, LHA, LPD, and NSC platforms.

Implementation

The Huntington Ingalls Industries – Ingalls Shipbuilding (Ingalls) sees an opportunity to implement this technology selectively within the large team currently assigned to testing. Situations where ambient ultrasonic conditions are low present opportunities to use the UL 101 and accomplish faster testing with better results. Implementation is underway with planned purchases for equipment and training by the Ingalls testing superintendent.

PERIOD OF PERFORMANCE:
July 2017 to May 2018

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
CNM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$511,000

Development of Low-Cost, Corrosion-Resistant Composite Canister

PERIOD OF PERFORMANCE:
October 2017 to October 2018

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(843) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D
PEO Integrated Warfare Systems
(PEO IWS 2.0)

TOTAL MANTECH INVESTMENT:
$361,000

M2735 — Nulka Decoy Composite Canister

Objective

Corrosion of the Nulka MK 234 Decoy canisters, which house the decoy round and are located inside the launcher, is a major system sustainment cost driver. The present sustainment activity assessment indicates that approximately half of the canisters require repair during the normal four-year depot cycle, with almost all canisters requiring repair by the second four-year depot cycle, equating to an eight-year service life. Severe corrosion often results in replacement of the complete canister. The objective of this project was to develop a low-cost, corrosion-resistant composite canister and manufacturing approach suitable for both new construction and retrofits to extend the life cycle of the Nulka MK-234 Decoy canister.

This integrated structure requires Electromagnetic Interference (EMI) shielding, grounding, electronic communication pass through, and long-term water tight seals. Composites are an obvious choice, but hybridized technology (e.g., comingled / integrated EMI shielding) provides the opportunity to integrate the required elements while maintaining the canister's structural requirements. Recent EMI and materials developments and testing conducted by Naval Surface Warfare Center - Crane and subcontractor were leveraged as a starting point.

Payoff

The remodel maintains form, fit, and function of the canister while significantly improving reliability and life-cycle duration / costs. Optimization of the materials and improvement of corrosion resistance and manufacturing processes have improved affordability, manufacturing, and performance. The novel composite canister will facilitate both new construction and retrofit. The new canister will demonstrate comingled / integrated EMI shielding technologies in order to achieve a more cost-effective and lighter weight system. The anticipated return on investment for this effort is 55:1 based on a total savings of $12M to the program.

Implementation

This project developed, manufactured, and demonstrated an optimized low-cost, corrosion-resistant decoy canister using state-of-the-art composite materials and processes. Transition of the new technology is not dependent on program schedule constraints and is ready for implementation based on the end of this Navy Manufacturing Technology project in the first quarter of FY19.

RFID Technologies Will Improve Material Handling Processes

S2737 — RFID Part Delivery Tracking and Visibility

Objective

Material management activities are one of the key cost drivers in shipbuilding construction processes. Additionally, difficulties in capturing equipment status and the absence of real-time location information frequently lead to errors that further disrupt delivery efforts and commonly result in downstream delays of production schedules. Capturing, maintaining, and utilizing material and equipment location data is a complex process within the shipbuilding environment due to a variety of factors, including severe weather conditions, constantly shifting priorities, and limitations on vacant storage areas within the shipyard. These and other challenges frequently result in the need for materials, planning, and production organizations to assign unplanned labor to properly status and locate material throughout the shipyard.

Through the DDG 51 Radio-Frequency Identification (RFID) Part Delivery Tracking and Visibility project, General Dynamics Bath Iron Works (BIW) expects to optimize material tracking processes and minimize key cost drivers, such as excessive paper-based documentation and ineffective statusing of materials. By integrating RFID tracking into material handling processes and incorporating material statusing and location details into the Material Resource Planning system, BIW anticipates significantly reducing material location inefficiencies within current processes and optimizing production schedules.

Payoff

BIW anticipates a 30-percent reduction in material tracking-related activities through the incorporation of RFID technology. Following full implementation in late 2020, the optimized material handling process at BIW is anticipated to produce savings of $1.56M per DDG 51 hull and five-year savings of more than $6M.

Implementation

Following the identification of opportunities where RFID technologies can be integrated to best optimize material locating and delivery processes, BIW expects to implement the technology using a phased approach, which will occur incrementally at the conclusion of each phase of the project. Full implementation is anticipated in late 2020 during the production of DDG 51 hulls. Activities that will be required to implement the technology include integration of RFID hardware throughout the shipyard, process documentation updates, and system training. Schedules and the level of effort required for implementation activities are dependent on future project results.

PERIOD OF PERFORMANCE:
May 2018 to February 2021

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$1,272,000

Capitalizing on Early Component / System Testing in the Shop Environment

PERIOD OF PERFORMANCE:
August 2017 to May 2018

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$511,000

M2742 — Packaged Unit Testing

Objective

The objective of this DDG 51 Class destroyer project was to capitalize on early testing in a shop environment versus later in a more expensive manufacturing environment. The project evaluated industry 'best practices' to determine the optimal level and type of testing that can be performed on equipment packaged units. The study determined specific requirements that enable early testing, performed a pilot on an existing package unit to evaluate construction and testing requirements, evaluated support equipment needed for early testing, and assessed support equipment options that capitalize on efficiencies achieved by testing in a controlled environment.

Payoff

The results of this project will develop shop environment testing of packaged units / structures in lieu of 400 area (i.e., open weather construction and testing) or late stage shipboard testing. Implementing machinery packaging and testing in a controlled shop-type environment, across multiple contracts, will maximize the cost-saving benefits associated with earlier component / system installation and test completion. Anticipated five-year savings across DDG 51, LHA, and LPD platforms are $3.4M.

Implementation

During execution of the project, a basic list of requirements for a future package construction and testing facility was identified. The results of this project indicated that process changes will be necessary in order to achieve the maximum benefits of early package unit testing. Further facility enhancements to address the requirements identified have been developed and approved, and efforts are underway to incorporate these facility changes. A phased implementation plan for FY18, FY19, and FY20 has been developed.

High-Speed Rotating Welding Arc Process for Navy Surface Ship and Submarine Applications

S2752 — High Speed Rotating Welding Arc Process

Objective

The objective of this project is to test and assess various materials and joint designs for the high-speed rotating welding arc (HSRWA) process on the DDG 51 Class destroyer, VIRGINIA Class submarine (VCS), Virginia Payload Module (VPM), and COLUMBIA Class submarine (CLB) platforms. The project will also conduct shipyard testing to develop an implementation strategy. The first phase will establish NAVSEA requirements and test plans for full-penetration plate welds. General Dynamics Bath Iron Works (BIW) and General Dynamics Electric Boat (GDEB) will identify candidate applications and develop technical acceptance test plans to compare shipyard baseline weld processes to the HSRWA process. Concurrence will be obtained from the appropriate NAVSEA authority. The second phase of the project will further examine a narrowed field of weld candidates and positions to determine the required testing for NAVSEA weld procedure qualification of the HSRWA process. BIW and GDEB will define weld procedure support test plans with guidance from Naval Surface Warfare Center, Carderock Division technical advisors and will perform testing on site.

Payoff

BIW and GDEB anticipate savings from utilizing HSRWA technology for surface ship and submarine applications. The shipyards expect to be able to reduce bevel machining costs by using square groove edge preps instead of bevels, the number of weld passes and torch positions required for V-groove welds, weld distortion associated with a high number of weld passes, and rework due to the lack of sidewall fusion. Over the five-year period following implementation, GDEB projects savings of approximately $4.1M (over two CLB, two VCS, and eight VPM hulls) and BIW projects savings of approximately $1.69M (over six DDG 51 hulls).

Implementation

Based on the results of testing, BIW and GDEB will generate the data needed to submit to NAVSEA for process qualification packages, finalize the business case analyses, and create shipyard implementation plans. The transition event for this project is the shipyards' performance demonstration activities. Once those activities have been successfully completed, the process will have been verified to meet the expectations of the project teams and stakeholders and ready for implementation at BIW and GDEB. Implementation is anticipated between the first and third quarters of FY21.

PERIOD OF PERFORMANCE:
March 2018 to April 2020

PLATFORM:
DDG 51

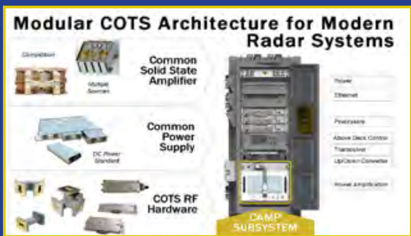
CENTER OF EXCELLENCE:
CNM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D, PMS 397, PMS 450

TOTAL MANTECH INVESTMENT:
$2,344,000

Open and Common Modular Building Blocks Will Enable Affordable Radars



PERIOD OF PERFORMANCE:
May 2018 to January 2020

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
EMPF

POINT OF CONTACT:
Mr. Thomas Gill
(610) 362-1200x215
tgill@aciusa.org

STAKEHOLDER:
PEO (Ships), IWS 2.0

TOTAL MANTECH INVESTMENT:
$5,800,000

S2755 — Open and Common RF Building Blocks Enabling Affordable Radars

Objective

This Electronics Manufacturing Productivity Facility project will produce a prototype of a modern radar system architecture that introduces open and common radio frequency (RF) components to demonstrate the capability to implement requirements of two significantly different radar systems. This effort represents the baseline for the Navy's Next Generation Surface Search Radar (NGSSR). The proposed open and common architecture will meet multi-mission requirements for current and next generation surface ships. Under this project, an industry competition will be held to determine all reduction costs of identified modular RF components.

Payoff

The benefits of this project include cost reduction through a competitive search of solid-state amplifier industry domain manufacturers, with potential acquisition cost savings estimated at 25 percent of the unit costs over 200 units for NGSSR as compared to traditional traveling-wave tube-based designs. The potential for reuse of the technology demonstrated in this project also increases the economy of scale for military procurement; NGSSR will be installed on every Navy Surface Search Ship, replacing the AN/SPS-73(V)12. In addition, the project will provide higher reliability of the power amplifier and extensive commonality among military radars through the use of modular components; the open modular approach also offers greater commonality and a more efficient technology refresh, which will have a broad economic and technical impact over several radar programs.

Implementation

This project will provide a demonstration prototype that proves that the open building block architecture approach meets the capability to implement the requirements of modern radar systems. The effort will include the generation of a Technical Data Package for the NGSSR that will be used for formal request for proposals, enabling an open and fair competition for full rate production and manufacture of the NGSSR prototype for field testing to demonstrate hardware and software capabilities of solid-state high-power amplifier technology.

Analysis of Alternatives of Design and Manufacturing Approaches for Deck Edge Safety Nets

S2764 — Deck Edge Safety Net Composite Frame Feasibility Assessment

Objective

Surface combatants have deck edge safety nets (DESN) installed around the perimeter of the flight deck. The safety net frames are subjected to various stresses in-service as well as weather and marine effects. The frames can deform during the fabrication process due to the material, geometry, and weld-induced stress. Metal frames are heavy, prone to corrosion, can be difficult to weld, and can be bent or broken when subjected to sea loading.

Under a previous project, composite DESN frames were manufactured and laboratory tested at Naval Surface Warfare Center, Carderock Division (Evaluation of Composite Deck Edge Safety Net Structure). An at-sea test (Composite Deck Edge Safety Net Proof of Concept Demonstration Onboard USS Arleigh Burke [DDG 51] of a comparable composite DESN frame was also conducted and provided valuable lessons learned for assembly design details and at-sea load definition.

The purpose of this Composites Manufacturing Technology Center project is to perform a comprehensive-requirements review and an Analysis of Alternatives (AoA) of design and manufacturing approaches to determine the best option to decrease the manufacturing and life-cycle cost of surface ship composite DESN frames while meeting all performance requirements. In order to determine the viability of this endeavor, a composite DESN system AoA will be executed that focuses on the following three key variables: manufacturing approach, material system(s), and viable component designs.

Payoff

During the AoA, Huntington Ingalls Industries - Ingalls Shipbuilding provided data for manufacturing, the acquisition cost of the current DESN frames, and the life-cycle cost based on the repair history. This data, along with down selected concepts and manufacturing approaches will be used to develop an accepted approach.

Implementation

The Project Plan for a phased project is under review for the development of a production-ready alternative composite surface ship DESN frame accompanied by an approved manufacturing process.

PERIOD OF PERFORMANCE:
October 2018 to April 2019

PLATFORM:
DDG 51

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 400D, PMS 501, NAVSEA

TOTAL MANTECH INVESTMENT:
$194,000

LCS Projects

S2558-1-2 — Manufacturing Cost Reduction for LCS Scalable Electronic Warfare (EW) System Phase 1 and 2 52

Open Architecture Will Improve Reliability for Electronic Warfare

PERIOD OF PERFORMANCE:
March 2014 to April 2019

PLATFORM:
LCS

CENTER OF EXCELLENCE:
EMPF

POINT OF CONTACT:
Mr. Thomas Gill
(610) 362-1200 x200
tgill@aciusa.org

STAKEHOLDER:
PMS 501, PMS 378, PMS 500

TOTAL MANTECH INVESTMENT:
$7,710,000

S2558-1-2 — Manufacturing Cost Reduction for LCS Scalable Electronic Warfare (EW) System Phase 1 and 2

Objective

The Electronic Warfare Expanded Scope project includes two objectives – to develop a Common Modular Power Supply (CMPS) and to investigate advanced manufacturing techniques for a common open architecture downconverter.

There is an urgent need for a high-reliability, above-deck power supply for the Surface Electronics Warfare Improvement Program (SEWIP) AN/SLQ-32(V)6. The current power supply exhibits high failure rates. Taking advantage of advancements in power supply design and manufacturing methods and the trend toward open architecture and commercial-of-the-shelf components, this project aims to develop an open modular power supply architecture that maximizes the use of readily available commercial components adapted to military environments. The architecture provides for N+1 redundancy along with continuous monitoring of critical performance measures to create a highly reliable, battleshort capable power supply with low Mean Time to Repair. The open architecture allows any competent power supply vendor to provide modules for the CMPS, increasing competition and a path for technology insertion as the state of the art progresses. The unit will be designed to be a drop-in replacement for the existing supply. A complete Technical Data Package (TDP) will be provided for future production, and the final report will include a description of technologies explored (e.g., silicon carbide semiconductors and 440VAC input source).

The downconverters provide an opportunity to reduce cost through commonality of design and improved manufacturing methods. The current downconverters will be characterized and alternate manufacturing methods will be explored.

Payoff

The CMPS will provide the SEWIP system with reliable power to improve overall availability. Its open architecture will permit improvements in power supply technology to be transitioned without the need to upgrade or replace the basic unit and will increase competition, thereby lowering acquisition costs in the long run. This will lower life-cycle costs and provide much improved uptime. Being modular, the CMPS can be adapted to other systems that require multiple output voltages. By changing or adapting the input module, various input voltages can be accommodated. Further savings can then be achieved through commonality of design and shared sparing costs.

The downconverter studies will provide a path for a lower-cost alternate source if the current supplier can no longer provide the downconverters. Characterization of the legacy units will ensure compatibility of any potential new design and areas for performance improvements.

Implementation

PEO IWS 2.0 will establish the schedule to implement the results of the EW Expanded Scope project for SLQ-32(V)6 through the Program of Record acquisition change process. EMPF will provide a prototype CMPS and complete TDP for evaluation and qualification. A detailed report on the downconverter study will be provided for potential future use.

VCS / CLB Submarines Projects

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S2593-A-B — Critical Resource Planning 55
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Development of Fire Safe Resins for Submarine Applications

PERIOD OF PERFORMANCE:
April 2018 to April 2019

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$640,000

Q2533-2 — Composite Manufacturing Technology for Fire Safe Resins Ph 2

Objective

Significant research has been performed to bring the benefits of composite materials to the submarine community, and numerous projects that have reduced acquisition and life-cycle costs, decreased weight, and improved manufacturing lead time have transitioned to submarines. However, until now, these applications have been limited to the outside of the pressure hull. Components internal to the pressure hull require Fire, Smoke, and Toxicity (FST)-safe material systems. While some existing phenolic systems have been approved for use within the submarine pressure hull, they have been unreliable due to high void content, relatively high manufacturing cost, and complexity.

The objective of Phase 1 of the project was to identify materials and develop fabrication processes to manufacture submarine components, and to demonstrate the ability for these materials to meet an FST requirement. Phase 2 continues to identify and improve manufacturing processes that reduced the phenolic void content and improve the design allowables. Mechanical properties were generated to replace outdated design information that was based on the legacy phenolic resin process. Phase 2 continues to identify affordable, novel, and commercially available materials and approaches to bring composites within the pressure hull.

Payoff

Phase 2 of this project will identify processes, methodologies, and materials that can be used to bring composites within the pressure hull. The applications will remove metal components in highly corrosive environments, thereby reducing the life-cycle costs of submarines. The manufacturing improvements made to phenolic core systems and phenolic laminates can be leveraged to applications industry-wide and provide far-reaching improvements to multiple Department of Defense platforms.

When considering the use of the MT-1853 material system for the VIRGINIA Class submarine (VCS) FTS, estimated savings of approximately $50K per system are expected from reduced acquisition costs related to the manufacture of the components using less expensive materials.

Assuming implementation on all Block V VCS and following ships, as well as all COLUMBIA Class submarines (CLB), total estimated acquisition savings of $2.2M are possible. The return on investment is 2.5:1 over the total life of both VCS and CLB programs

Implementation

This project is a follow-on project to Q2533-1. Fire Safe Resins Phase 2 will fabricate an actual submarine component for insertion in a VCS hull.

Critical Resource Planning Tool Predicts Impact of Change Events

S2593-A-B — Critical Resource Planning

Objective

The objective of this VIRGINIA Class submarine (VCS) and COLUMBIA Class submarine (CLB) project was to identify or develop a software application that provides a means to more efficiently monitor and forecast the use of critical shipyard resources (transport barges, transporters, strongbacks, etc.), as well as, reduce costly ship production delays associated with unavailability of resources. Teaming with the Naval Shipbuilding and Advanced Manufacturing Center (NSAM) and General Dynamics Electric Boat (GDEB), the Institute for Manufacturing and Sustainment Technologies (iMAST) conducted an extensive market survey of commercial resource planning and project management software. After concluding that no existing applications would meet all the documented user requirements provided by GDEB, iMAST developed the Critical Resource Planning (CRP) software application.

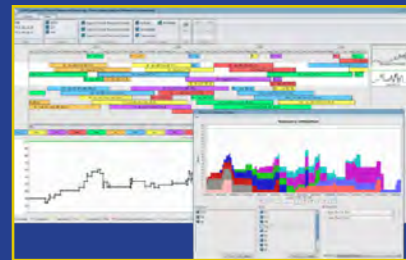
Payoff

The CRP software tool, extensively tested by GDEB, provides statistical data for the assessment of impacts due to schedule changes, added work, or manufacturing assembly plan changes. In addition, the tool can be used to predict the total cost of a change event or to understand the total cost of a proposed plan with respect to critical resource utilization. This technology reduces planning effort and eliminates many production and ship delivery delays and will save an estimated $246K per VCS hull, $199K per CLB hull, $100K per year in barge shipment reduction, and $660K over five years in commercial barge engineering support, resulting in a five-year return on investment of 1.2:1.

Implementation

The final CRP software release was delivered to GDEB at the completion of the ManTech project in March 2018, where it was anticipated to be implemented in a production environment in the fourth quarter of FY18. The final deliverable included the executable software as well as source code, which allowed GDEB to conduct a final evaluation of the software and ensure that it presents no cyber security risks and can support users in the GDEB planning department. Implementation at other U.S. Navy shipbuilders is possible with minor software modification and reconfiguration.

This project was a joint Center of Excellence effort with Naval Shipbuilding and Advanced Manufacturing (NSAM) and the Institute for Manufacturing and Sustainment Technologies (iMAST).



PERIOD OF PERFORMANCE:
September 2015 to May 2018 (NSAM)
October 2015 to March 2018 (iMAST)

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
NSAM
iMAST

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$1,045,000 (NSAM)
$520,000 (iMAST)

Novel Low-Cost Composite Solutions for Virginia Payload Module

PERIOD OF PERFORMANCE:
April 2015 to December 2018

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$2,284,000

S2601— Low-Cost Hybrid Fairings

Objective

This Navy Manufacturing Technology effort further refined and developed gateway technologies, techniques, and processes that demonstrated that cost-effective design and manufacturing solutions are achievable with acceptable risk for faired structures fabricated from composite and / or hybrid material systems. Several innovative technologies used either individually or in conjunction with one another are under consideration for use in VIRGINIA Payload Module (VPM) configurations. Each employs the use of enhanced composite materials with integrated stiffness and damping, or a combination thereof, to form the fairings that make up the boundary of the VPM.

Payoff

Successful incorporation of the project results into the VPM design has the potential to provide significant total ownership cost savings to the VIRGINIA Class submarine (VCS) for Block V and following ships. For the remaining class of VPM-enabled ships, acquisition savings are estimated to be up to $2M, and life-cycle savings for all of the options included are estimated to be between $18M and $21M, depending on the implementation schedule. Potential weight savings are estimated to be approximately 7,600 lbs. with implementation of hybrid composite forward and aft fairings.

Implementation

The Low-Cost Hybrid Fairing (LCHF) project completed a major design review which resolved stakeholder concerns from a number of disciplines. Notably, the preliminary assessments for shock indicated acceptable results for the LCHF and substructure. However, the meeting revealed additional design concerns related to the alignment of the safety track, isolation of the carbon for cathodic protection, and performance technical readiness level of the hybrid material. Testing and analysis activities were scheduled through August 2018 to resolve or mitigate performance concerns. On successful completion of the project, the technology will be available for incorporation into current redesign activities on VCS VPM. The project results will also facilitate consideration for similar technology insertion into COLUMBIA Class components and structures of comparable design / function. The implementation targets are SSN 806 and following ships with anticipated implementation to occur in FY20.

Alternative Coating and Surface Preparation Solutions Offer Significant Savings for Submarines

S2649 – VIRGINIA Class Submarine Alternative Coating and Surface Preparation Solutions for Ball Valves

Objective

Currently, green Teflon® coatings are used as a solid film lubricant to reduce the operating torque of the ball in the valve assemblies. The coating on the air system ball valves (ASBV) peels and wears after a low number of cycles, potentially causing an increase in seal wear and operating torque. Teflon® peeling of ball valves has increased inspection rejections, which increases re-work and acquisition costs. The project goal is to identify, test / evaluate, and implement potential alternative coating systems, coating deposition processes, and/or surface modification processes that improve the performance and extend the life cycle of ASBV. Finding the root cause failure mechanism will help identify the coating properties / surface modifications that meet the minimum performance requirements. The coated ASBV / seating material interaction is being evaluated to serve as a baseline. Currently, four potential solutions are being evaluated: improved Teflon® coating process, improved seat / ball materials, super-finished valve balls, and a diamond-like carbon coated valve ball.

Payoff

Approximately 400 Teflon®-coated valve balls are required to achieve full qualification acceptance for approximately 200 ball valve assemblies due to the rejection rate during acquisition. An improved coating system will eliminate the need to rework the ASBV and save approximately 50 percent of the total acquisition cost. General Dynamics Electric Boat (GDEB) estimates savings of over $100K per boat in materials for baseline VIRGINIA Class submarines (VCS) and $334K per boat due to planning / engineering, which result in a total acquisition savings of $434K per boat. Over five years, at two boats per year, this correlates to $4.3M in savings with a return on investment (ROI) of approximately 2.85:1. There is also a potential acquisition savings of $755K per VIRGINIA Payload Module (VPM) and $2.1M per COLUMBIA Class submarine (CLB) due to the increased number of ASBV per boat. The VPM savings are for the whole submarine; therefore, the savings include the $434K for the rest of the submarine. If additional benefits from CLB are considered, and only two CLB are assumed to be built in the same five-year period, an additional $4.3M in savings will be realized. In addition, if two VPMs are built within the 10 VCS, an additional $642K in savings will be realized, and the revised five-year ROI is 7.20:1.

Implementation

This project will be implemented in late FY19 on new construction VCS and on existing hulls on an attrition basis. GDEB and NAVSEA are committed to this project as a means of reducing acquisition total ownership costs for VCS and CLB. The project's results will significantly reduce source inspection rejections and unplanned maintenance. Implementation will be accomplished through drawing changes and will require successful coating or surface modification development by iMAST to be qualified and certified by NAVSEA technical authorities.

PERIOD OF PERFORMANCE:
March 2016 to February 2019

PLATFORM:
VCS / CLB Submarines

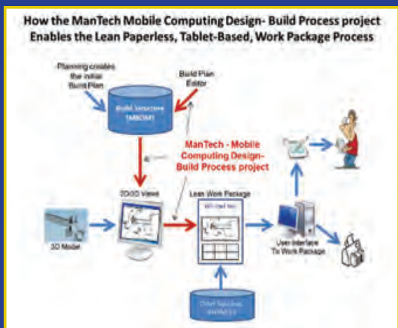
CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$1,127,000

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



PERIOD OF PERFORMANCE:
March 2016 to April 2018

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$977,000

S2653 — Mobile Computing for Design Build

Objective

The VIRGINIA Class submarine (VCS) uses work instructions and traditional engineering drawings to complete builds. These drawings can be very cumbersome, difficult to read, and time-consuming to manage because VCS work instructions come with traditional engineering drawings that contain much more information than is needed for a particular work task. VCS legacy data does not contain the level of data that is contained in the COLUMBIA Class submarine (CLB) product design. When VCS data is migrated / translated to the computer-aided-design system, some of the data may be lost. General Dynamics Electric Boat (GDEB) approached this issue by generating 2D Manufacturing Assembly Plans (MAPs) that acted as references to the drawings. The MAPs contained only the information needed to accomplish a particular task and were organized into a preferred build sequence with colored 3D graphics. While effective, the process was very time-consuming.

The project created tools and processes to enhance GDEB's lean work package, structural fabrication, and outfitting system. The team developed a lean paperless work package, with graphics geared only to the work at hand, that was built from the legacy VCS product model. Conversion of the legacy VCS design data allowed for the creation of Build Authority (BA) views and models. BA models provide graphical views that represent build (as opposed to design) geometry. These tools and processes support shift-level work instructions that are delivered on a tablet for the GDEB Quonset Point Facility using legacy VCS (post migration), CLB, and VIRGINIA Payload Module data. The project focused primarily on work instructions for structural fabrication. However, the expected outcomes are applicable to other disciplines.

Payoff

The Mobile Computing Design-Build Process is revolutionizing the approach to shipbuilding and has generated additional innovative ideas. GDEB demonstrated a 25-percent efficiency with the use of MAPs and is now able to produce 40-percent more MAPs annually. GDEB has also demonstrated a 15-percent improvement in MAP revisions. These production gains translate into cost savings of $367K per VCS hull and five-year savings of $3.67M.

Implementation

The GDEB IT Department will handle distribution of the project results as well as data integration with other GDEB data sources. Project implementation into a production environment started in the third quarter of FY18 on SSN 798.

Development of Hull Tile Manufacturing Improvements and Automated Preparation to Save Time and Cost

S2655-1 — Automated Manufacturing of Hull Tiles Phase 1

Objective

This Composites Manufacturing Technology Center project investigated and developed an improved manufacturing technique for large and/or complexly configured submarine hull tiles. This was accomplished through a combination of catalysis and automation, and resulted in the reduction of the cycle time and improvement of the manufacturing rate and response time to tile design and formulation changes. The effort developed a catalyzed casting process, which reduced labor and the need for ovens and supporting equipment. Catalyzed casting is a prerequisite for any future automation of this process. Automation of other shipyard applications, such as blasting, painting, and abrading outer hull surfaces, was also evaluated.

This effort is applicable to Block V, back-fit on VIRGINIA Class submarines (VCS), and potentially COLUMBIA Class submarines (CLB).

Payoff

The primary benefit of the project is the ability to reduce the manufacturing time and labor associated with large and/or complexly configured tiles, while using existing treatment material formulations. The project resulted in a catalyzed casting technique for the large and/or complexly shaped tiles, the reduction of time / man-hours required to manufacture the tiles, as well as the removal of the cost for a large oven to cure the tiles at the elevated temperature.

The catalysis process will reduce the time required to manufacture a set of tiles and will increase the size of each tile set. Because the number of tiles manufactured in the set will no longer be dependent on the oven size, the tile cycle time could be reduced by up to 50 percent.

Implementation

Implementation will occur in the form of an updated manufacturing process for hull tiles, and upon qualification will be implemented in builds starting in 2018.

PERIOD OF PERFORMANCE:
February 2016 to November 2018

PLATFORM:
VCS / CLB Submarines

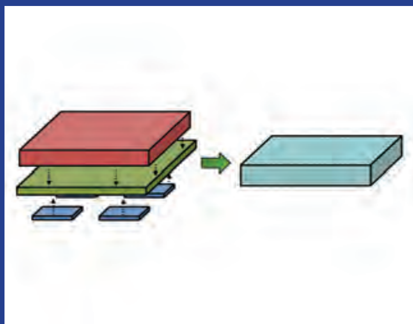
CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$1,173,000

Development of Multi-Functional “Plug-and-Play” Composites for Submarine Applications



PERIOD OF PERFORMANCE:
June 2017 to March 2019

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$2,775,000

S2677 — Plug-and-Play Composites

Objective

Submarine hull exterior components often require significant manhours to apply supplemental, non-structural materials. In many cases, to meet a multitude of requirements, several different materials are employed. The project will develop and successfully demonstrate that a multi-functional “plug-and-play” composite part (a single part with all functional attributes of the original multi-material system) can arrive from the vendor ready for shipboard installation. Many existing composite applications currently require supplemental / transitional coating applications, which could be eliminated or facilitated by the development of the proposed technology. Potential applications could be more attractive as a result of improved business cases.

Payoff

Successfully designed and manufactured plug-and-play composite components are anticipated to offer both acquisition and life-cycle benefits. The principal benefit from acquisition involves the reduction of the labor associated with the installation of supplemental materials to structural components in post-fabrication. Receiving a component from the vendor, ready for installation, will also lower labor costs and reduce scheduled installation time for the shipyard.

Additional benefits are expected from reduced life-cycle maintenance. Savings will be realized from reduced repair and replacement of the supplemental materials due to damage and loss during normal operations over the life of the submarine. Replacement of steel components with plug-and-play composite versions is also expected as a result of this project and will reduce life-cycle costs through the avoidance of corrosion.

Combined acquisition and life-cycle savings are estimated to be approximately $63.8M, based on 30 VIRGINIA Class and 12 COLUMBIA Class submarines.

Implementation

Additional applications are being investigated for implementation of this technology. Applications could include, but are not limited to, non-pressure hull access covers / hatches, control surfaces, and external fairings.

Optimized Sheet Metal Shop Capabilities Will Reduce Costs and Span Times

S2702-A-B — Sheet Metal Modernization

Objective

General Dynamics Electric Boat (GDEB) is planning for an increase in production volume for the Quonset Point Sheet Metal Fabrication Shop to accommodate the production rate increase for the VIRGINIA Class submarine (VCS), which now includes construction of the VIRGINIA Payload Module (VPM), and the upcoming construction of the COLUMBIA Class submarine (CLB). The increased production rate will affect the overall shipbuilding schedule; therefore, GDEB is evaluating the legacy sheet metal shop to modernize in preparation for the increase in work. GDEB is looking for areas that can be streamlined with the implementation of automated manufacturing engineering tools and the development of manufacturing product data from the 3D product model.

The project will optimize the sheet metal shop by implementing capabilities and processes that maximize shop efficiency, new and proficient designs, and an error-proofing system. The first objective is to reduce the touch time required by the lofting group. The second objective is to make shop floor improvements that will increase efficiencies. Models and/or analysis methods to evaluate the impact of proposed changes are needed to validate the current and future states of the sheet metal shop. Lastly, machine technologies and capabilities will be evaluated and compared to the existing equipment, resulting in a plan that will expand shop capabilities and reduce span time. The project will focus on sheet metal assembly, cutting and punching technologies, and forming and bending capabilities.

This project is being executed in two phases. Phase 1 is comparing the current shop capabilities to potential future changes and developing manufacturing engineering tools or a computer-aided-design application. Phase 2 will design and develop potential future state shop alternatives and include a process model-based evaluation. Development of the sheet metal manufacturing engineering software application will continue and a prototype application will be demonstrated and delivered.

Payoff

The project will streamline GDEB's sheet metal fabrication process by implementing automated manufacturing engineering tools and developing manufacturing product data from the 3D product model. This increase in efficiency is anticipated to reduce lofting and support services for the CLB Class by 10 percent, resulting in one-time savings of $1.8M and $90K savings per hull. In addition, the project's shop floor improvements will provide a 3-percent reduction in man hours, resulting in savings of $270K per VCS hull, $359K per VPM hull, and $567K per CLB hull, resulting in five-year savings of over $7.2M.

Implementation

Upon successful completion of the project and approval from management, GDEB will implement the updated processes and technologies into its production environment. Project implementation is anticipated in the fourth quarter of FY19 on SSN 801 and SSBN 826.

PERIOD OF PERFORMANCE:
August 2017 to August 2019

PLATFORM:
VCS / CLB Submarines

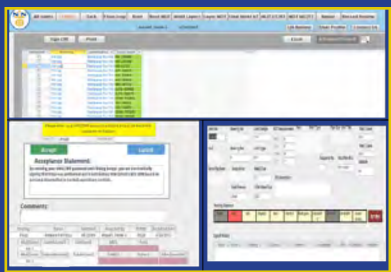
CENTER OF EXCELLENCE:
NSAM
iMAST

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,427,000

Replacing Paper Weld Records with an Electronic System Will Save VCS $13.5M



PERIOD OF PERFORMANCE:
November 2016 to August 2019

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$965,000

S2703 — Electronic Weld Record System

Objective

Welding processes at Huntington Ingalls Industries - Newport News Shipbuilding (NNS) require over 25 different forms, including Non-Destructive Testing (NDT). These forms are manually completed and signed by hand. Information recorded on the forms must be captured and retained to meet NNS procedures and/or government requirements. This process leads to handwritten errors, difficulty interpreting handwritten data, missing data fields, misplaced records, and time-consuming tracking, reviewing, and certifying records for accuracy and completeness, which impacts NAVSEA audits and system testing.

The purpose of this VIRGINIA Class Submarine (VCS) project is to develop an electronic weld record system to eliminate paper records and to replace them with an electronic system. The web-based system will be accessible to all users (e.g., welders, auditors, managers, SUPSHIP, fitters, and inspectors) through the NNS network using a desktop, mobile device (e.g., tablet), or kiosk. The first phase mapped out the current and future state processes, developed an electronic prototype, and defined the technical requirements. The electronic prototype will help determine the welding, NDT, inspection, and IT software / hardware requirements. The applicable process owners, program owners, users, SUPSHIP, and NAVSEA will review the requirements to ensure that all issues and technical input are being considered and met. Phase 2 focuses on system development, which includes coding, testing, evaluating, verifying, validating that the software works as determined to meet the end customer / business requirements, and a stakeholder demonstration of the developed system.

Payoff

This technology, once implemented, could potentially save an estimated $1.5M per VCS hull. The estimated savings per year are approximately $2.9M (based on nine VCS in-process hulls per year). For five years, the savings are approximately $13.5M.

Implementation

Upon successful and timely completion of the project and acceptance of both the technology and associated business case by the acquisition Program Office, the results will be transitioned to the NNS facility. Implementation is anticipated in the fourth quarter of FY19.

Improved Inspection Techniques for Submarine Pressure Hulls Will Save Maintenance Costs

Q2711 — Inspection Under SHT Phase 1

Objective

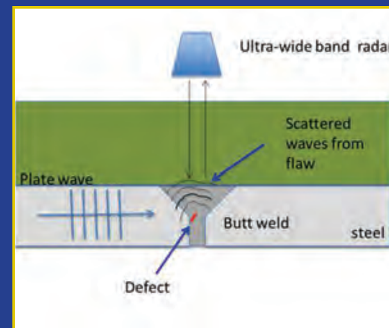
The Navy Metalworking Center (NMC) conducted a Navy ManTech project to potentially reduce the cost of the periodic inspection of submarine pressure hulls. The current processes, including visual and ultrasonic inspection, require the removal of significant amounts of special hull treatment (SHT) to access the hull structure underneath, followed by the reinstallation of SHT after the inspection. SHT removal, inspection, and reinstallation are on the critical path for the schedule of a submarine availability. Technologies that can inspect directly through SHT, or minimize the amount of SHT that needs to be removed, would significantly reduce the cost of hull inspection. Technologies investigated during this phase 1 effort included the use of a microwave interferometer, phased array ultrasonic (UT) with reduced contact area, and combined terahertz / ultrasonic imaging.

Payoff

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

Implementation

Of the three inspection technologies investigated, only phased array UT was able to successfully detect both weld flaws and loss of thickness (i.e., simulated corrosion flaws) in the test articles. Though this technology requires the removal of SHT, the removal can be minimized as the process allows imaging of the entire weld region from only one side of the weld. The other inspection technologies were not able to definitively detect the weld flaws through the SHT. The shipyards have completed qualification of the phased array UT inspection technique, and NAVSEA is reviewing the corresponding inspection procedure for final approval. Based on this information, a Phase 2 effort was not recommended.



PERIOD OF PERFORMANCE:
February 2016 to July 2018

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
NMC

POINT OF CONTACT:
Mr. Robert E. Akans
(814) 262-2349
akansr@ctc.com

STAKEHOLDER:
PMS 450, NAVSEA, PMS 406

TOTAL MANTECH INVESTMENT:
$625,000

Commonality for Temperature Measurement and Control in the Shipyard

PERIOD OF PERFORMANCE:
October 2018 to September 2020

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David Ditto
(724) 295-7011
dhd10@arl.psu.edu

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$1,082,000

S2747-— Automated Preheat Temperature Monitoring

Objective

Many facets of submarine construction involve the controlled heating of materials during welding processes to ensure the quality of welds. In submarine construction, the rigid monitoring and controlling of temperatures during welding are highly manual processes. Workers continuously monitor the temperature of welded sections and adjust the heater controls to maintain the correct temperature profiles. Weld preheat and post-welding heat treatment processes, which require manual temperature monitoring, measurement, and documentation methods, use significant amounts of labor.

This project will follow a proven systems engineering approach to develop an automated temperature monitoring and digital reporting solution. The initial phase will develop and optimize physical attachment methods, temperature correlation, and logistics in a relevant environment. The project will also define the requirements for data processing and its integration with temperature control systems. The results of the project will be a detailed technical report and shipyard implementation plan for automated temperature monitoring in a shipyard environment.

Payoff

There is presently a group of technicians who are responsible for manually monitoring and documenting temperatures for critical heating processes at General Dynamics Electric Boat (GDEB). According to GDEB, the time involved in manual temperature monitoring is roughly 9,000 hours per year, or about $340K per VIRGINIA Class submarine hull. The vision of this project is to automate the monitoring processes so that these technicians can spend more time performing setup tasks and only correct out-of-limit processes. By having access to critical material temperature data, the project will develop a new level of temperature traceability that could enhance weld issue diagnosis capabilities in the future.

This project will benefit shipbuilding and submarine manufacturing by replacing manual monitoring and measurement processes with automated, reliable, and cost-effective methods. The techniques and methods developed for the welding processes could be used for coating, plating, and other applications that also require controlled heating and temperature-monitoring processes.

Implementation

Because of the wide applicability of the temperature-monitoring scenarios and methods, this project has included specific tasks that drive commonality into implementation of the methods. The Penn State Applied Research Laboratory - Electro-Optics Center (EOC) and GDEB engineers are working together to ensure that the resulting functional system specification will be implementable. Where development work is required at EOC laboratories, an accompanying transition to a non-production task at GDEB has been included to assure that shipyard personnel are current with the methods that are being developed. The knowledge gained during the task, in conjunction with the resulting system specification document, will ensure successful shipyard implementation. Implementation to occur in year 2022 on SSN 801.

Predictive Facilities Maintenance and Capacity / Production Planning Systems to Reduce Costs and Meet Manufacturing Schedules

S2750 -— Diagnostic and Predictive Monitoring for Facilities Equipment

Objective

Unplanned equipment maintenance has a profound effect on the production capacity of manufacturing facilities and shipbuilding schedules for both the VIRGINIA Class and the COLUMBIA Class submarines. While many capacity and production planning tools can organize the production schedule around planned maintenance events, most cannot quickly re-plan for unexpected equipment failure. The objective of this project is to initiate implementation of a predictive health monitoring system at General Dynamics Electric Boat (GDEB), and to integrate the information into the production planning and scheduling capabilities to reduce the impact of downtime due to maintenance.

Payoff

This Institute for Manufacturing and Sustainment Technologies (iMAST) project will identify, evaluate, and implement equipment health monitoring systems to more accurately predict failures, which will lead to improved planning and scheduling. The project is expected to reduce schedule disruptions due to maintenance, which will lead to improved schedule performance, reduced outsourcing, and lower inventory costs. GDEB estimates annual savings of $400K per year and five-year savings of $2.0M; the five-year return on investment (ROI) is 1:1. This very conservative estimate does not include the labor savings for re-planning from the capacity planning and only includes initial project instantiations of this capability. The full final business case, including many critical manufacturing assets and equipment, such as cranes at Groton and Quonset Point, will provide a very high ROI.

Implementation

The project will begin with a machinery degrader analysis to determine the critical failure modes that the selected health management technology can support. The appropriate capacity planning tools will be enhanced to accept maintenance information and to display this information to the users. Phase 2 will expand the implementation of the predictive maintenance system and integrate this information with the Critical Resources Planning Tool. iMAST will provide the tools and hands-on training to GDEB. Software interfaces will be developed and implemented in the third quarter of FY19 to connect condition information to the enhanced capacity planning tools, which will increase the effectiveness of the tool and scheduling.

PERIOD OF PERFORMANCE:
May 2017 to May 2019

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$950,000

Robotics and Automation Will Improve Submarine Hull Insert Installation

PERIOD OF PERFORMANCE:
May 2018 November 2020

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
CNM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$1,333,000

S2751 — Robotic Process for Welding Hull Inserts

Objective

The legacy process to install inserts in submarine hulls is an intricate sequence of events that consists of multiple manual operations, including cutting, beveling, grinding, and welding processes. Requiring extensive labor in excess of 45K manhours per hull, hull insert installation significantly expands the manufacturing span time for the initial outfitting phase. Since weld quality is dependent on tribal knowledge and individual skill level, additional rework is often required. Because this process is entirely manual, a robotic installation solution would improve weld quality and has the potential to reduce the labor required for submarine build schedules. These welds are much more complex than linear welds in a fixed welding position. Welding parameters must change multiple times as the weld torch moves along the curvature of the hull through various welding positions. Cutting and beveling holes in the hull requires constant varying of the bevel angle on the hull and the insert to keep the weld joint's angle consistent as the hull curvature changes around the circumference of the weld. Because of the complexities of each individual process, there are no readily available commercial-off-the-shelf technologies capable of performing all of the integral steps of this complex process.

The objective of the project is to develop a robotic system to install hull inserts on VIRGINIA and COLUMBIA Class submarines (VCS and CLB, respectively). The solution technology will leverage previous robotic and automation efforts conducted at General Dynamics Electric Boat (GDEB) to develop a hull insert installation robot capable of automating each individual step while maintaining the tight tolerances required of submarine fabrication processes.

Payoff

Through automation and weld quality improvements, a 20-percent reduction in cutting, fitting, and welding labor is forecast. Through increased efficiencies and quality improvements enabled by the technology, GDEB anticipates savings of $1.60M per VCS hull and $2.59M per CLB hull for combined five-year savings of $21.23M across both programs.

Implementation

Based on the results of testing, GDEB will generate the data needed for process qualification packages to submit to NAVSEA, finalize the business case analyses, and create shipyard implementation plans. The transition event for this project is GDEB's performance demonstration activities. Once those activities have been successfully completed, the process will have been verified to meet the expectations of the project teams and stakeholders and will be ready for implementation at GDEB. Implementation is anticipated in the third quarter of FY22.

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

Development of Automated Assembly Planning Software Will Improve Shipbuilding Structural Assembly

S2758 — Automated Assembly Planning and Work Package Information Generation

PERIOD OF PERFORMANCE:
October 2017 to December 2019

PLATFORM:
VCS / CLB Submarines

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PMS 450, PMS 397

TOTAL MANTECH INVESTMENT:
$830,000

Objective

The objective of this project is to develop a process and tools that automatically generate an assembly plan for structural fabrication of the VIRGINIA Class submarine (VCS) and the COLUMBIA Class (CLB) submarine. The plan will then be supplemented with additional information, converted to a digital work package, and delivered to General Dynamics Electric Boat (GDEB) tradesmen on the shop floor using the platform and processes established in the Navy ManTech S2653 Mobile Computing for Design Build project conducted by the Naval Shipbuilding and Advanced Manufacturing Center.

Phase 1 focuses on the documentation of assembly rules and preferences for structural fabrication of submarine assemblies and the development of the software tool to augment the build authority model. In addition, the project team is developing requirements and methods for the generation of electronic work packages in an open format. Finally, Phase 1 is also conducting the initial development (an extension of tools developed by the Defense Advanced Research Projects Agency) of the assembly planning algorithms and will conclude with prototype system results for test assemblies.

In Phase 2, the project team will mature the structural fabrication assembly sequencing tool based on feedback obtained during Phase 1 prototype testing. The electronic work package data / information generation process and software will be finalized, and the two developed technologies will be integrated. The project team will also test the efficacy of auto-generated assembly sequences for candidate assemblies and demonstrate the generation of electronic work package data to obtain feedback and refine the software.

Payoff

Savings will result from reductions in planning labor hours, production control inventory, and shop floor job planning hours. The estimated planning labor-hour reduction is 1,000 hours for VCS and 2,000 hours for CLB, which will result in $300K savings. In-process inventory is estimated to be reduced by 0.5 percent and result in $10K savings for both VCS and CLB. Shop floor planning hours are expected to be reduced by 1,600 labor hours and 3,200 labor hours for VCS and CLB, respectively, resulting in an estimated combined savings of $480K. This results in total five-year savings of $4.45M and a return on investment of 3.32:1.

Implementation

Upon successful completion of this project, the tools and methods will be transitioned to the VCS Program at GDEB in early 2020. Post-project technology insertion will be limited to full-scale deployment of the piloted technologies / improvements developed during the project. GDEB management has expressed its commitment to implementing these tools and methods in an effort to reduce VCS production costs for two subs per year and one CLB per year.

F-35 Lightning II Projects

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Improved Seal System to Save F-35 Lightning II Millions of Dollars

PERIOD OF PERFORMANCE:
April 2013 to February 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$2,425,000

PennState
Institute for Manufacturing
and Sustainment Technologies

A2513 — F-35 Automated and Rapid Seal Installation

Objective

Complex shaped and contoured F-35 Lightning II doors and panels tend to require a larger number of seal details to properly conform to the part. The objective of this Composites Manufacturing Technology Center project was threefold: develop technologies to reduce the seal details required per door / panel, develop an ultrasonic seal hole cutting device, and develop an improved seal adhesive application system.

Payoff

The project significantly reduced the cost to fabricate and install seals on F-35 doors and panels. Technologies developed on this project are expected to save millions of dollars in material and labor costs. The cost savings largely result from reducing the labor associated with fabricating seals, applying and cleaning the seal adhesive, and cutting holes in the seals once installed. Cost savings of at least $30M are anticipated. Total F-35 seal cost savings are anticipated to be over $100M for the program.

Implementation

Development of ultrasonic seal hole cutting was completed in 2014 and implemented in production in 2015. Cost savings of nearly $7M are anticipated from this technology. Development of complex seal forming technology was finalized in 2015, and initial production implementation began in 2018. Complex seal forming technologies implemented on seals to date are anticipated to save nearly $80M over the course of F-35 production with more implementation expected in the future. Additional implementation of the complex seal forming technology will be coordinated through the F-35 Affordability and/or Change Request processes. The project will return to the Affordability Initiative Review Board for evaluation and approval for implementation funding. Development of the pressure-sensitive adhesive application technology was finalized in 2018, and implementation is expected in 2019.

Technology Will Reduce Defects from Out-of-Contour Waviness

A2583 — Smart Processing Manufacturing Technology

Objective

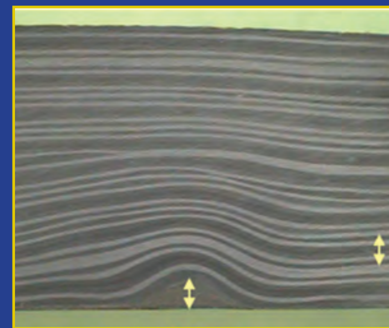
Fighter jet wing and nacelle skins are complex layups produced from carbon bismaleimide prepreg material using the fiber placement process. Highly tailored layups, which involve numerous steep contour changes, have resulted in a defect condition called Out-of-Contour Waviness (OCW). OCW results in costly Material Review Board (MRB) activity. Significant effort has gone into determining the root cause of OCW without success. To date, no root cause of OCW has been determined. This Navy Manufacturing Technology, Composites Manufacturing Technology Center (CMTC) project collected thousands of data points available from each part fabrication and applied pattern recognition and Bayesian methods to identify and understand the variables that affect OCW. Variables identified from this early analysis were used to develop a design of experiments (DOE) in which numerous panels were fabricated and inspected for OCW. Data gathered from the first DOE shaped a follow-on DOE, which will be used to narrow in on the root cause of OCW in the components and to develop improved fabrication process parameters that yield OCW-free parts.

Payoff

The project identified the 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 Lightning II program are estimated at approximately $20M. The cost savings are 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 level of approval required for this type of change would be minimal, though the cost to implement is highly dependent upon the identified variables. The transition to implementation is a series of defined process variables that are controlled more tightly, while remaining within the current process specification.



PERIOD OF PERFORMANCE:
November 2014 to March 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$3,103,000

PennState
Institute for Manufacturing and Sustainment Technologies

Process Improvements to Meet Strict F-35 Primer Thickness Requirements

PERIOD OF PERFORMANCE:
August 2015 to November 2017 NSAM
October 2015 to March 2018 iMAST

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
NSAM
iMAST

POINT OF CONTACT:
Mr. Marty Ryan
(843) 646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$341,000 NSAM
$600,000 iMAST

PennState
Institute for Manufacturing
and Sustainment Technologies

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

Objective

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

This project developed a method to provide painters with the ability to estimate the cost of rework resulting from deficient panels. The project team investigated multiple tools / methods capable of proving thickness measurements of the primer coating over composite panels without damaging the primer surface or requiring additional rework. Following a downselect, the preferred technology was then developed for implementation into F-35 production.

Payoff

Early estimates forecasted a 20-percent reduction in rework activities related to primer thickness. Assuming a Low Rate Initial Production (LRIP) 11 implementation during the 1st quarter of FYI9, the estimated reduction correlates to a per-aircraft savings of $31.2K and total program savings of over $62M. The project is anticipated to decrease the labor and costs associated with rework, improve first pass quality, and reduce process span time.

Implementation

This technology will be disseminated to individual part suppliers enabling the supply base to accurately apply and assess the primer coating on their parts prior to shipment, eliminating tedious rework during the later stages of the production process. Accurate measurements of the primer coating thickness will improve first pass quality and eliminate the mandatory rework required for out-of-tolerance panels. If the technology proves successful, Lockheed Martin anticipates implementation of the primer thickness measurement technology in LRIP 11 during FY19.

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

Automated Optical Inspection for Reduced Cost of EOTS Sapphire Panel Assemblies

A2620 — Optical Evaluation of Sapphire Panels

Objective

The project developed an automated optical inspection (AOI) system to use in pilot production for the inspection of the F-35 Electro-Optical Targeting System (EOTS) sapphire window assembly. The automated system will inspect roughly 86 percent of an EOTS interior and exterior window assembly (the remaining approximately 14 percent requires manual inspection due to installation constraints and system mechanical limitations), and will analyze the data to produce results based on Mil-Spec standard criteria. This project focused on the inspection of gridded / coated sapphire panels assembled in frames and factory-produced aircraft structural panels; however, the technology developed here is also applicable to a variety of scratch / dig inspection scenarios.

The inspection approach evaluates critical functional defects and analyzes their impact on the performance of the entire optical system. This includes functional defects that diminish infrared transmission and reduce the sensor imaging performance, and defects that reduce the mechanical strength of the sapphire panel, potentially causing early system failure over the operational life cycle.

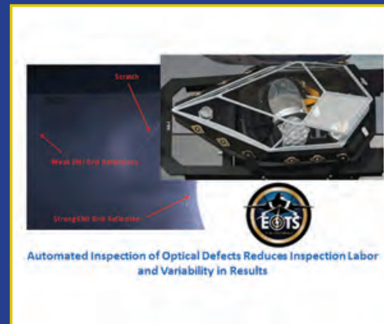
Payoff

Automating optical inspection will greatly improve the process by producing objective and repeatable results while also providing a quality characterization that is more relatable to system performance over the operational life cycle. Automated inspection of panels will reduce labor, lower costs, decrease variability, and increase throughput. Because this technology may be extended to other optical panels with Mil-Spec scratch and dig criteria, 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. In addition, the project results also apply to multi-faceted and conformal sensor windows, regardless of their substrate material, and to existing programs (e.g., F-35) if the inspection capability is extended to include bare, "as-manufactured" panels and assemblies returned from the field for depot-level evaluation and repair. Potential future applications may include EOTS enhancements and the Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) sensor windows. The acquisition affordability savings are projected to be over $4M for the F-35 Program alone.

Implementation

The development of an AOI test station is a pilot project to prove out automated inspection technology on military sensor windows. The prototype system will be validated for the production of EOTS windows by successfully verifying the detection algorithms and demonstrating the production cost savings. The system will be used by Lockheed Martin Missiles and Fire Control for acceptance of the EOTS sapphire window assembly beginning in early 2020. EOTS production builds for airframe LRIP 13 are delivered in 2020, one year ahead of LRIP 13 aircraft delivery in 2021. The prototype test station throughput supports all future F-35 factory production rates up to 24 units per month. The Technology Transition Plan describes how the AOI system may be replicated and adapted as necessary for additional F-35 depot and/or field support uses within three to five years.

Hardware and software developed under this effort can benefit other U.S. Government platforms. The basic automated inspection technology can be applied wherever scratch and dig inspection is required. AOI algorithms are flexible and easily adapted to the evolving inspection criteria often encountered in new designs. The Electro-Optics Center will identify cost-saving projections for candidate applications explored as part of this project, such as single panel and new program window designs. Potential programs include Lockheed Martin's Sniper (Advanced Targeting Pod) system, currently in production.



PERIOD OF PERFORMANCE:
January 2015 to September 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

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

TOTAL MANTECH INVESTMENT:
$3,221,000

PennState
Institute for Manufacturing and Sustainment Technologies

Process Improvements for New F-35 EOTS Detector Material

PERIOD OF PERFORMANCE:
March 2017 to April 2020

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

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

TOTAL INVESTMENT:
$1,997,000 - Navy ManTech
$325,000 - Air Force

PennState
Institute for Manufacturing and Sustainment Technologies

J2622 — F-35 Electro-Optical Targeting System (EOTS) Producibility Ph 4

Objective

Leveraging the success achieved in the three phases of the F-35 Lightning II Electro-Optical Targeting System (EOTS) Producibility projects, this project will continue to drive down the cost and risk of key EOTS infrared components while transitioning the EOTS mid-wave infrared integrated Dewar cooler to a high operating temperature advanced detector.

Payoff

Insertion of the new detector into the current EOTS configuration will provide multiple affordability advantages, from increased capacity and reduced focal-plane array (FPA) processing hours and span time to increased reliability and maintainability of the integrated Dewar cooler assembly. The FPAs will also be more uniform and manufacturable and have better yield and performance than the current FPAs. Together, these tasks are expected to save over $62M for the F-35 Program.

Implementation

The F-35 EOTS is the transition platform. These producibility improvements will be implemented as process changes are qualified and cut into production before completion of the project. The manufacturing process-level changes are only required to go through the normal Santa Barbara Focalplane Process Control Board. 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 project final report.

Implementation for the airframe's low rate initial production (LRIP) 13 is in 2021, and delivery of EOTS production builds for LRIP 13 is in 2020, one year ahead of the aircraft delivery in 2021. This is a joint effort with Air Force Research Lab.

Improving Imaging Systems by Reducing Coating Defects

A2623 — EODAS Nodule Defect Reduction

Objective

Multilayer vapor deposition coatings are used in imaging systems to reduce reflection and increase transmission of light into the detector. Small defects in coatings can create a scatter site for entering light, or completely block one or more detector elements. Coating defects can arise from several sources. Imbedded particles which have been over-coated will result in a spherical cap nodule 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 coatings could significantly help improve the yield of detector systems. This project had a dual-methods approach: to reduce the formation of nodule defects through an improved coating process, and to develop a laser ablation process to efficiently remove nodule defects without damaging the remainder of the wafer.

Payoff

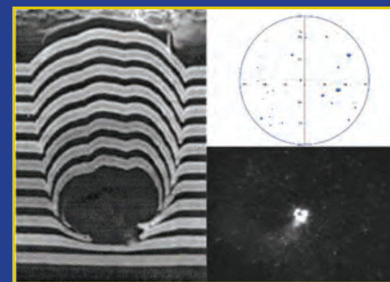
When nodule defects occur, focal-plane array (FPA) performance can be degraded, often through the creation of cluster defects (several adjacent non-functioning pixels). The current mitigation strategy of polishing flatness into the filter wafer can result in scuffing, which can degrade all or most of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

The project significantly reduced the potential for the imaging systems to malfunction due to multilayer coating issues. The payoff is measured as improved yield of FPAs. For F-35, estimated cost savings of $3,864 per aircraft were implemented in 2017 from yielded improvements in filter wafers, reduced labor for wafer repair, and improved yield in FPA downstream processing.

Implementation

The primary transition platform for this project is the F-35 Electro-Optical Distributed Aperture System (EO / DAS) sensor system. The EO / DAS consists of six infrared sensors mounted around the F-35 structure. The infrared sensors are one of the primary cost drivers for the EO / DAS. Coating process improvements demonstrated on this project were communicated to the supply chain and implemented in 2017.

The technique of laser ablation for nodule defect mitigation was demonstrated as a viable and cost-effective option for nodule defect mitigation. This process can be implemented in the future on F-35 with a capital investment, if needed, or on any multilayer coating.



PERIOD OF PERFORMANCE:
June 2015 to September 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

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

TOTAL MANTECH INVESTMENT:
$903,000

PennState
Institute for Manufacturing
and Sustainment Technologies

Reduce Costs and Improve Producibility of Infrared Imaging Systems

PERIOD OF PERFORMANCE:
June 2015 to February 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

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

TOTAL MANTECH INVESTMENT:
$436,000

PennState
Institute for Manufacturing and Sustainment Technologies

A2624 — F-35 EOTS Producibility Phase 2

Objective

The Pennsylvania State University Electro-Optics Center (EOC) and Santa Barbara Focalplane improved the producibility of the infrared components comprising the F-35 Lightning II Electro-Optical Targeting System (EOTS). This phase of the project consisted of two additional process improvement tasks: the focal-plane array (FPA) quick test and the improved Dewar final vacuum bake.

Payoff

The FPA quick test reduces handling and scrap while automation of the Dewar vacuum bake station reduces labor and span time. The anticipated benefits of a six-percent reduction in cost per unit and projected affordability savings of over $30M for the F-35 Program were not realized at the end of the project. A four-percent reduction in cost per unit and affordability savings of over $18M have been realized to date, and the full estimated savings are anticipated upon implementation of the FPA quick test in FY 2019, after insertion of a new detector material.

Implementation

The F-35 EOTS is the transition platform. The Dewar vacuum bake producibility improvement was implemented as a process change, qualified, and cut into production before completion of the project. Manufacturing process-level changes are only required to go through the normal Santa Barbara Focalplane Process Control Board. The analysis and validation were executed within the confines of the project schedule and were documented in the project final report. Implementation of the FPA quick test task is on hold until the new detector material is qualified and approved for implementation into the F-35 EOTS production line in FY 2019.

OLED Head-Mounted Display Makes Difference of Night and Day

A2627 — OLED Display for F-35 HMD

Objective

This project will develop and demonstrate a manufacturing process to assemble an organic light-emitting diode (OLED) display into the existing optical train of the F-35 helmet-mounted display system (HMDS). Government Accountability Office (GAO) report 18-321 (June 2018) stated that the current liquid crystal display (LCD) on F-35 exhibits a characteristic “green glow” during low-light flights, which makes it difficult for the pilot to see the full resolution of the night vision video feed. The GAO report concludes that “Organic light-emitting diode displays avoid this effect by only illuminating the active pixels.” To make the OLED technology affordable, this project is reducing part count, total parts cost, and touch labor in the manufacture of OLED HMDS.

Payoff

In addition to technical performance improvements, this project will demonstrate cost savings in assembly time and parts handling: part count is projected to be reduced by 27 percent, and touch time labor is projected to be reduced by 10 percent through improved tooling concepts. The projected savings are a 21-percent reduction in cost per HMDS, for a total program savings of over $40M. The return on investment is 7.1:1.

Implementation

This ManTech project is integral to the initial operational capability (IOC) for the F-35C, which is scheduled to be achieved in early 2019. A quantity of 62 OLED flight helmets have been ordered for IOC trials. F-35 prime contractor Lockheed Martin has planned additional qualification testing, which will take the helmet to a Release Authorization Notice 6 production helmet in 2019.

PERIOD OF PERFORMANCE:
August 2017 to November 2019

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
EOC

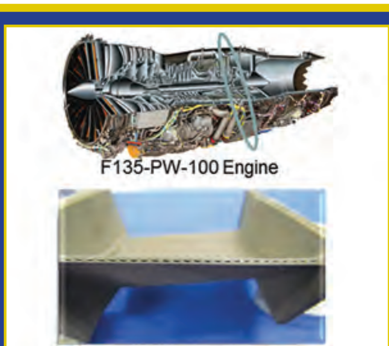
POINT OF CONTACT:
Mr. David H. Ditto
(724) 295-7011
dhd10@arl.psu.edu

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

TOTAL MANTECH INVESTMENT:
$3,900,000

PennState
Institute for Manufacturing
and Sustainment Technologies

Automated Manufacturing Solutions for F-35 Lightning II Engine Part to Save Costs and Improve Quality



PERIOD OF PERFORMANCE:
July 2015 to October 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
NMC

POINT OF CONTACT:
Mr. Robert E. Akans
(814) 262-2349
akansr@ctc.com

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

TOTAL MANTECH INVESTMENT:
$ $2,344,000

PennState
Institute for Manufacturing and Sustainment Technologies

A2632 — Automated Turbine Airfoil Trailing Edge Rounding

Objective

A Navy Metalworking Center (NMC) led Integrated Project Team (IPT) developed technologies to more accurately establish F135 engine turbine airfoil trailing edges, which are typically manually ground to obtain the desired contour. The current process results in high labor costs, as well as deviations in the trailing edge profile that cause both yield and quality concerns. Previous development efforts by Pratt & Whitney (P&W) have demonstrated the capability of a force- and vision-adaptive robotic system to profile grind the blade trailing edges; however, other adaptive grinding processes are potentially viable. The IPT, comprised of the F-35 Joint Program Office, P&W, Arconic, and NMC, developed an adaptive grinding system to establish the required turbine airfoil trailing edge profiles.

Payoff

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

Implementation

The project team worked with industry to develop and demonstrate a robotic profiling system that has successfully shaped the trailing edge on single edge airfoils. Based on these results, the team worked to adapt this system to assess whether it can establish a defined profile on doublet airfoils. P&W and Arconic will use the results of these evaluations to establish a business case for implementation of the adaptive grinding solution in FY20.

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

A2656 — F-35 Assembly Metadata Integration

Objective

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

The F-35 Program is implementing production rate step increases, which will reduce the center fuselage production process interval by 25 percent. The ramp in deliverable requirements will continue until the current four-day-per-unit rate is decreased to a maximum throughput of one day per unit in 2019. This escalating production rate will only add to the congestion that is currently present in areas where support functions must allocate a significant percentage of their time addressing quality challenges.

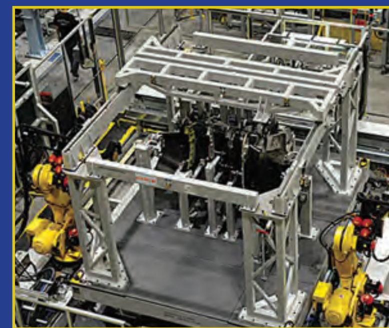
The primary focus of this project was to design an integrated process to extract quality data from key machines on the IAL, which will automate and eliminate tedious review and disposition activities required of current quality processes. This project also focused on providing sufficient visibility to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

Payoff

The integrated process will reduce the number of manhours required to address quality issues by 46 percent, resulting in per aircraft savings of $11.6K. Following a scheduled implementation in 2018, this significant per-aircraft labor reduction will result in a JSF Program savings of more than $28M.

Implementation

The project is anticipated to automate and eliminate tedious review and disposition activities required of current quality processes. Northrop Grumman Aerospace Systems expects to implement the improved process into the production environment in LRIP 11 during the first quarter of FY19.



PERIOD OF PERFORMANCE:
August 2016 to February 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
864-646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$1,933,000

PennState
Institute for Manufacturing and Sustainment Technologies

Improved Surface Preparation Process to Save F-35 Lightning II Millions of Dollars

PERIOD OF PERFORMANCE:
October 2016 to November 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(843) 646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$2,665,000

PennState
Institute for Manufacturing and Sustainment Technologies

A2657 — Plasma Surface Preparation for Composite Nutplate Installation

Objective

The current surface treatment method to install nutplates on the F-35 Lightning II is inconsistent and involves a labor-intensive hand-sanding and wiping operation. This effort will deliver an efficient, cost-effective, and safe atmospheric plasma treatment system, including processing parameters, which will produce reliable bonds and prepare composite substrates on the F-35 for nutplate installation in a measurable, repeatable manner.

Payoff

A plasma system that can reach at least 85 percent of the composite nutplate areas will be developed. This system will enable savings in four areas by eliminating the push-off test requirement in production; eliminating scrap, rework, and repair due to poor surface preparation; reducing the labor associated with preparing the composite surface for bonding; and reducing material consumption by eliminating sanding disks and a portion of the current solvent wipe process. Total cost savings resulting from implementation of a suitable plasma surface prep process are anticipated to save nearly $14M for F-35.

Implementation

After successful demonstration, the plasma system is expected to be implemented through the F-35 Affordability and/or Change Request process. Upon evaluation and approval by the Affordability Initiative Review Board, the plasma surface preparation technology will be implemented in factory locations that bond nutplates. Implementation is scheduled to occur in 2019.

Automated Hybrid Manufacturing Processing to Reduce Cost of Composite Structure Fabrication

Q2688 — AFP/ATL Hybrid Structures

Objective

The ability to fabricate complex parts that are both more affordable and also minimize weight is challenged by today's manufacturing offerings, as currently utilized in F-35 production. The Navy is currently contemplating future systems, such as the Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS), Tactically Exploited Reconnaissance Node (TERN), and the next-generation fighter aircraft (F/A-XX). While these platforms are still in the early concept development stages, it is probable that large, complex-contoured skins will be part of any offering. Prime contractors' ability to meet both the affordability and performance goals of these platforms will be challenged. A novel hybrid-manufacturing solution that could offer the weight optimization abilities of the Automated Fiber Placement (AFP) process and the affordability benefits of the Automated Tape Layup (ATL) process is highly desired.

This Navy Manufacturing Technology (ManTech) project will demonstrate the technical capabilities and the potential cost and weight savings of the new hybrid AFP/ATL technology. Northrop Grumman Innovation Systems (formerly Orbital ATK) and Fives have developed a dockable gantry system (DGS) with interchangeable AFP and ATL heads that have the entire fiber path and fiber delivery system located on the dockable head itself. The premise is to combine the strengths of both AFP and ATL and to minimize the weaknesses by optimizing the two technologies to fabricate composite structures. Currently, composite part fabricators typically have equipment that is capable of either only ATL or only AFP. Deciding which process to use to fabricate a specific part is simple. If the geometry of a small area of a part exceeds the capabilities of the ATL equipment, the entire part is then fabricated with AFP, or the entire part may go to hand lay-up. Successful demonstration of this new technology will enable future Navy systems to achieve the affordability benefits of ATL and the performance benefits of AFP.

Payoff

Preliminary simulations comparing the hybrid AFP/ATL process to traditional AFP on an F-35 conventional takeoff and landing upper wing skin show the potential for as much as a 13-percent reduction in materials cost and a 17-percent increase in material deposition rate.

Implementation

The results of this project could support both current acquisition programs like F-35 as well as future acquisition programs, such as the UCLASS, TERN, and F/A-XX. For future programs, since these projects are still in the early development phases, no specific implementation plan will be prepared.

Demonstrating this technology in 2018 will enable future platforms to make informed, baseline decisions on part design and fabrication options by understanding the cost and weight implications of such decisions. With respect to current platforms, the F-35 may require additional wing part fabrication capacity dependent on the full production build rates that are achieved. If the F-35 supply chain requires additional equipment, successful execution of this project would enable the part producers to make informed decisions about the proper equipment to purchase to support the increased rates. If the supply base elects to use the DGS system, then typical F-35 implementation methodology will be followed.

PERIOD OF PERFORMANCE:
May 2016 to December 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(843) 646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$1,595,000

PennState
Institute for Manufacturing and Sustainment Technologies

Enhancements to F-35 Canopy Clean-up Automation Cell to Save F-35 Lightning II Millions of Dollars

PERIOD OF PERFORMANCE:
February 2017 to April 2018

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(843) 646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$455,000

PennState
Institute for Manufacturing
and Sustainment Technologies

A2704 — F-35 Canopy Clean-up Automation – Pad Changing

Objective

A Composites Manufacturing Technology Center project successfully developed an automated canopy sanding system for the transparency of the F-35 Lightning II under a previous Navy Manufacturing Technology (ManTech) project that will yield significant savings. However, because the sanding pads require changing every 5-10 minutes, significant operator intervention is still necessary. This project developed the equipment, processes, and methods to improve a system that will autonomously change adhesive-backed sanding pads.

Payoff

When the automated pad changing system is incorporated with the automated canopy sanding system, further savings will be achieved and the complexity of production will be reduced by virtually eliminating the need for an operator during the sanding operations. Total savings of millions of dollars are anticipated over the life of the F-35 program.

Implementation

After the pad changing system is successfully demonstrated, it will be implemented at the canopy manufacturer on existing and future automated canopy sanding systems. The ManTech-developed automated canopy sanding system in place at the canopy manufacturer will be modified to accommodate the newly developed pad changing system to demonstrate system operation and to validate the anticipated cost savings. Future canopy sanding systems will be procured that include the pad changing system. Implementation is expected to occur in 2019.

F-35 Blind Fastener Preparation System Will Provide Efficiencies, Production Savings

M2740 — Automated F-35 Blind Fastener Preparation

Objective

Blind fasteners are manually installed into the forward fuselage of the F-35 Lightning II. The current process, which requires significant hours per unit, involves multiple mechanics in each area to clean and apply sealant to the substructure, locate the skins to the structure, and install temporary and permanent fasteners. Prior to installation, each fastener is cleaned and promoted. Due to lubrication inside the sleeve in the locking mechanism of the blind fasteners, the fasteners cannot be cleaned using a slosh method and are instead cleaned and promoted individually to ensure that the cleaner / promoter does not enter the mechanism.

Individual cleaning and promoting of blind fasteners are labor-intensive processes that require a fine paint brush to apply the cleaner / promoter to the fastener after which the fasteners must dwell in open air for 15-plus minutes after each application to ensure sufficient drying prior to handling. The tasks occur in the work area where the fasteners are used and must be installed within eight hours or the process must be repeated. This project will develop an automated blind fastener preparation system to apply cleaner and promoter to large quantities of blind fasteners to eliminate the current "one-at-a-time" method. The system will also accelerate drying time after applications to further reduce preparation time.

Payoff

The conventional take-off and landing forward assembly contains over 790 blind fasteners and the Electronic Mate and Assembly Stations (EMAS) have 290. To clean and promote the fasteners prior to installation takes an average of nine hours per unit and four hours per unit, respectively. Preparation time can be reduced by 56 percent in forward assembly and by 50 percent in EMAS, providing approximately $5.6M in production savings.

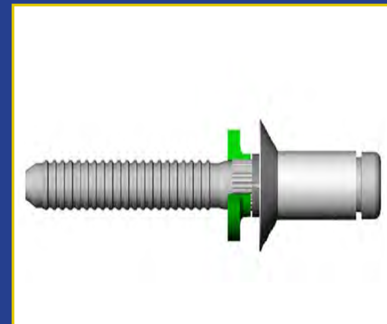
Increased shelf life is critical in order to allow enough time for the fasteners to be prepared and kitted for use in the automated installation system. The proposed system process will also increase shelf life for the fasteners by five days. The automated skin installation system is anticipated to impart 50-60 hours of savings per aircraft depending on the variant.

Implementation

A Technology Transition Plan (TTP) will be completed and signed within 90 days of contract award by the program stakeholders. If details within the TTP significantly change (schedule, business case, etc.) during the execution of the program, a revision will be drafted and the stakeholders will be required to resign. At the end of the project, the TTP will be updated, if required, to reflect current project results and detailed implementation plans will be developed for the selected applications that will include, but are not limited to, the following:

- Identification of Lockheed Martin project sponsorship
- Identification of qualification testing and changes to procedures, work instructions, and drawings
- Initial development of procedures for integration into operations
- Non-ManTech investments required in order to implement results and their source funding
- Tracking of cost savings through the Blueprint for Affordability program.

Implementation is anticipated to occur in FY2019.



PERIOD OF PERFORMANCE:
July 2018 to March 2019

PLATFORM:
F-35 Lightning II

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(843) 646-4512
marty.ryan@ati.org

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

TOTAL MANTECH INVESTMENT:
$450,000

PennState
Institute for Manufacturing and Sustainment Technologies

CH-53K Projects

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

PERIOD OF PERFORMANCE:
January 2016 to April 2019

PLATFORM:
CH-53K

CENTER OF EXCELLENCE:
EMPF

POINT OF CONTACT:
Mr. Thomas Gill
(610) 362-1200 x215
tgill@aciusa.org

STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$5,200,000

A2616 — CH-53K Ice Detection Repackaging & Affordability

Objective

The legacy ice detector for the CH-53K utilizes a radioactive isotope that presents an environmental and safety hazard and is expensive to dispose of and replace. An Electronics Manufacturing Productivity Facility project developed the CH-53K Ice Detector System (IDS), a unique ice probe / controller system that can reliably detect ice buildup (accretion) on the new Marine Corps CH-53K heavy lift helicopter while in hazardous weather conditions. The low footprint probe will perform equally well in low or high accretion rate environments and will provide pilots with unambiguous feedback on icy weather conditions to facilitate optimal decision-making. IDS uses a unique probe sensor and associated algorithms developed by FBS / Guided Wave under the Small Business Innovation Research program to accurately detect and precisely quantify the cylindrical probe's outer diameter as ice accumulates on the circumference.

Payoff

A safe, non-toxic, ice-sensing technology for future implementation on CH-53K offers major benefits in acquisition cost reduction and life-cycle support. The production cost for an equivalent commercial system that meets CH-53K requirements is estimated at $30K per unit based on 200 units. The ManTech effort is targeting an IDS production cost of $12K per unit, including a probe and controller, which calculates to $2.4M for 200 CH-53K units versus $6M for a commercial unit. Other benefits include:

- Ice-detection capability on thickness as low as 0.005 inches and capable of real-time tracking of ice accretion rate.
- Detects ice accretion in hovering and flying conditions because of its rugged probe.
- Meets or exceeds the performance of the legacy Strontium 90-based detector, eliminating the radiation hazard.
- Provides the Navy with a configurable controller that expands to include additional detection capabilities and adapts to other platforms.

Implementation

The transition event for the project will be the successful completion of the prototype IDS (passes environmental testing and the final ice tunnel test, and the test results are accepted by PMA-261) and the final update to the technical data package for the IDS design. The completed prototype for the CH-53K will transition to NAVAIR PMA-261 to undergo qualification testing and validation of airworthiness that is expected to begin third quarter FY 2019.

Smart Caul™ to Eliminate Scrap Parts for CH-53K

M2684 — Bulkhead T-Flange Crease Elimination

Objective

Autoclave-cured T-Flanged composite parts experience significant scrap rates due to bag side radius deformation and deltoid region deformation resulting from low pressure zones during the cure cycle. This project will develop and demonstrate a Smart Caul™ approach on CH-53K parts with T-Flanges to ensure adequate deltoid region and bag side radius formation to minimize scrap rates. This will be accomplished through multiple full-scale part builds to both develop the process and demonstrate repeatability. Finally, a full-scale teardown will be performed to ensure that the part fabricated with the Smart Caul™ meets all baseline production requirements.

Payoff

Implementation of this technology on CH-53K parts is expected to result in cost savings of more than $2M over the remaining production contract when implemented on CH-53K sponson bulkheads that contain T-Flanged parts and will result in a return on investment of over 4:1.

Implementation

Smart Caul™ will be implemented in production on CH-53K sponson bulkheads after the successful completion of the Composites Manufacturing Technology Center project in first quarter FY19. Initial implementation will be on the LH sponson bulkheads followed by the RH sponson bulkheads. Each sponson bulkhead will require a Smart Caul™ form tool, a Smart Caul™ layup tool, and the Smart Caul™. Minimal process changes are anticipated to implement the Smart Caul™ approach if it proves successful.

PERIOD OF PERFORMANCE:
October 2016 to December 2018

PLATFORM:
CH-53K

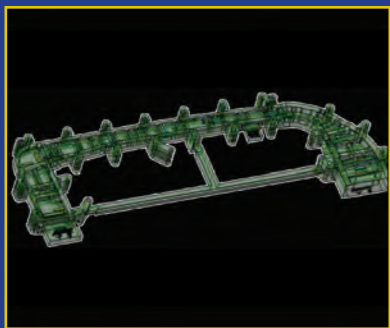
CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$4,000,000

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



PERIOD OF PERFORMANCE:
December 2015 to June 2018

PLATFORM:
CH-53K

CENTER OF EXCELLENCE:
NMC

POINT OF CONTACT:
Mr. Robert E. Akans
(814) 262-2349
akansr@ctc.com

STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$1,992,000

A2687 — CH-53K Frame Machining Distortion Mitigation

Objective

Part distortion that results from machining and heat-treating operations is a challenge for many industries, including the construction of naval weapons systems. The Navy Metalworking Center (NMC) led a project team to reduce distortion incurred while machining and heat treating aluminum alloy side cabin frames on the CH-53K heavy lift helicopter. The project team characterized the potential causes of distortion in the frames and then evaluated several technologies to mitigate the distortion. The primary solution was an improved integral bracing design for use during the quench process. This optimized design was developed through analysis and physically demonstrated and validated during the project. Machining improvements were also explored which provided smaller improvements to the distortion issue. Since distortion is a universal issue, the mitigation technologies developed in this project will potentially benefit other Navy platforms as well.

Payoff

The project will provide direct cost savings by reducing manufacturing rework and reducing scrap costs. Industry has reported that reducing or eliminating distortion in the side cabin machine frames is expected to improve quality and save $107K in cost per airframe, with a five-year savings of $7.5M on 70 units. The anticipated life-of-program savings are projected to be $20M based on 189 CH-53K cabin frames.

Implementation

Demonstration and validation were successful and the improved bracing has been fully implemented into the production process at the cabin manufacturer, Spirit AeroSystems, for the entire ship set of CH-53K side frames, starting with the STDA 5&6 units.

Low-Cost Radar Element Materials and Packaging

A2692 — Very-Low-Cost Radar for CH-53K DVE

PERIOD OF PERFORMANCE:
September 2016 to July 2018

PLATFORM:
CH-53K

CENTER OF EXCELLENCE:
EMPF

POINT OF CONTACT:
Mr. Thomas Gill
(610) 362-1200 x215
tgill@aciusa.org

STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$580,000

Objective

The Department of Defense (DoD) has a need for cost reduction in the application and use of low-cost Degraded Visual Environment (DVE) see-through systems across the spectrum of military systems. ACI Technologies Inc. / Electronics Manufacturing Productivity Facility (EMPF) Center of Excellence and the Penn State University Electro-Optics Center collaborated to develop, on behalf and under the guidelines of NAVAIR / PMA-261 (heavy lift Helicopter Program), a trade study of an integrated sensor technology that currently exists in industry. This trade study included a Request for Information (RFI) that elicited technical concepts to integrate a low-cost, scalable, open systems architecture (i.e., layered structure) see-through capability in a DVE for the CH-53K. The objective of the RFI process and subsequent evaluation was to assess the current industry capabilities to meet the DVE requirement to allow safe aircraft operations for a rotorcraft landing. The evaluation of the RFI responses included the development of trade study criteria, based on the information listed in the Product Description Criteria table included in the RFI. As a result of the trade study, PMA-261 was provided a recommendation based on the technical evaluation of the qualitative and quantitative data from the evaluation criteria.

Payoff

The benefit of doing this study was the development of a preliminary set of requirements, measurements of effectiveness, and white paper proposals for a realistic affordable concept for a DVE sensor solution for the landing DVE function on the CH-53K. This specification and the white papers solicited from industry identified the technology currently available, and could be used to solicit system designs and cost proposals from the radar industry. In addition, cost reduction could be achieved through manufacturing process upgrades.

Implementation

By developing new manufacturing processes in the development and construction of DVE sensor systems, there are opportunities for this cost reduction to propagate throughout the DoD rotary aircraft industry. This study provided a preliminary set of requirements for an integrated sensor solution, based on the white paper proposals for a realistic, affordable concept for a DVE sensor solution for the landing DVE function of the CH-53K. The technical investigation and trade study confirmed that the capabilities of a radio-frequency (RF) sensor solution integrated with a long-wave infrared sensor would allow the system to provide a see-through solution. A deeper investigation into the RF sensor capabilities identified in the white paper responses from industry could provide opportunities for affordability and cost reduction congruent with the established ManTech initiatives. The goal of this effort would be to develop an RF DVE prototype and Technical Data Package.

Testing of LWIR Cameras in a Degraded Visual Environment

PERIOD OF PERFORMANCE:
July 2018 to June 2019

PLATFORM:
CH-53K

CENTER OF EXCELLENCE:
EOC

POINT OF CONTACT:
Mr. David Ditto
(724) 295-7011
dhd10@arl.psu.edu

STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$750,000

M2730 — CH-53K Affordable Modular LWIR Camera

Objective

There is a need for imaging systems that provide improved visual capability and decreased operational risk during flight in Degraded Visual Environments (DVE). This project will primarily focus on dust (brownout conditions) generated during the final phase of landing in the CH-53K heavy lift helicopter. Current DVE imaging systems use Light Detection and Ranging (LIDAR) or other light-based systems that are expensive and only provide minimal visibility in obscured environments (typically two times the human visibility range under the same conditions). These light-based systems rely on long-distance imaging to create, see, and remember terrain mapping. Recently, high-sensitivity, cooled Long-Wave Infrared (LWIR) sensors have been developed for optimized performance in brownout conditions. These LWIR sensor systems have not been tested in the anticipated dust densities that will be generated during the approach and landing phase of the CH-53K heavy lift helicopter. The objective of this project is to evaluate the newly developed LWIR technology and to measure the camera's performance in a simulated dust-degraded environment.

Payoff

This project will identify new technologies capable of improving the performance of rotorcraft operating in degraded brownout environments. A reusable test plan and a set of procedures that can be employed for technical risk reduction and evaluation of future new and improved sensor systems for the CH-53K platform will be developed. A software model that can be used as new sensor technologies are developed will quickly establish a baseline for a sensor and compare its performance to existing sensor technologies. A model that simulates sensor system performance in DVE brownouts that is operational and verified against the data collected during field testing will be delivered to PMA-261. This model will enable low-cost performance evaluation of newly developed sensor systems. The project will define LWIR sensor performance metrics and establish requirements to help PMA-261 develop a vision system capable of operating in the DVE for the CH-53K heavy lift helicopter.

Implementation

The primary transition platform for this project is the CH-53K heavy lift helicopter. The software model and data obtained during this effort will be utilized to develop the specifications for sensor systems that will be deployed on the CH-53K. The plan is to develop a flexible model that can be tailored to different candidate sensor systems, facilitating cost savings for the selection of the appropriate sensor for multiple applications and programs. Candidate applications will be explored as part of this project, with recommendations for additional transition and implementation opportunities in FY21.

Cost Reduction through Innovative Streamline Composite Manufacturing of the CH-53K Main Rotor Hub Fairing

R2736 — Main Rotor Hub Fairing Phase 0

Objective

The current manufacturing process for the CH-53K main rotor hub fairing is costly, labor intensive, and includes many processing steps. The purpose of this Navy Manufacturing Technology, Composites Manufacturing Technology Center (CMTC) Rapid Response project is to evaluate whether an alternative manufacturing approach for the CH-53K main rotor hub fairing can substantially decrease the cost of the fairing with no negative impact to other part attributes such as weight, reliability and maintainability, and structural integrity. In order to determine the viability of this endeavor, a structured decision Analysis of Alternatives was executed that focused on the following three key variables: manufacturing approach, material system(s), and viable component suppliers.

Payoff

The anticipated cost savings of an alternative fabrication approach for the main rotor hub fairing as opposed to the current hand layup / autoclave process are $8M over 200 aircrafts which results in a return of investment of 4:1 or better.

Implementation

Contingent upon successful identification of key metrics, a follow-on CMTC project will be initiated to develop a production ready alternative composite CH-53K main rotor hub fairing and manufacturing process.

PERIOD OF PERFORMANCE:
May 2018 to October 2018

PLATFORM:
CH-53K

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
Marty.ryan@ati.org

STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$147,000

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

PERIOD OF PERFORMANCE:
July 2018 to June 2019

PLATFORM:
CH-53K

CENTER OF EXCELLENCE:
CMTC

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$350,000

M2738 — CH-53K Sandwich Panel Core Potting Optimization

Objective

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

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

Payoff

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

Implementation

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

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

Automated and Improved 3D Technical Data Management in a Model-Based Environment

M2757— 3D Data Exchange

Objective

Naval Air Systems Command (NAVAIR) is improving the area of accepting and managing data in a model-based environment. These improvements address issues that range from manually receiving technical data, initial verification and validation of the data received, and conducting engineering review and analysis concurrently to maintain configuration control to effectively support the aircraft. All of these issues can result in acquisition life-cycle delays and sustainment problems. Another challenge is providing downstream users with production-quality, model-based documents and Technical Data Packages (TDP) that can be processed by non-engineers and other downstream consumers, such as provisioning, sustainment, and manufacturers, with the detailed engineering and manufacturing information required for effective model-based communication and collaboration.

The 3D Data Exchange project has significantly streamlined NAVAIR PMA-261's receipt, verification, validation, and migration of technical data into the Product Lifecycle Management (PLM) tool. This technology allows technical data consumers to securely access the data and provides a solution for non-engineers to read and process the technical data by generating a neutral 3D PDF plus STEP AP203 TDP.

Payoff

The 3D Data Exchange project converted a totally manual process to a secure automated process. This was accomplished by receiving technical data from the original equipment manufacturer (OEM) directly into the NAVAIR PLM system. Once the technical data is received, the system validates the native CAD file, produces neutral readable formats, validates these files, and packages all related technical data into one TDP. Automating the process has significantly reduced the time and provided the ability for users internally and externally to access the data from a secure system. The 3D Data Exchange project is estimated to save $10.8M annually.

Implementation

PMA-261 started implementation in July 2018. The implementation is expected to take four to five months and will be ready to accept provisioning data from the OEM on time. This technology is expected to be used in other areas of NAVAIR.

PERIOD OF PERFORMANCE:
September 2017 to May 2018

PLATFORM:
CH-53K

CENTER OF EXCELLENCE:
NSAM

POINT OF CONTACT:
Mr. Marty Ryan
(864) 646-4512
marty.ryan@ati.org

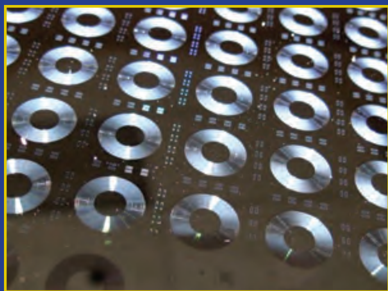
STAKEHOLDER:
PMA-261

TOTAL MANTECH INVESTMENT:
$504,000

Other Sea Platforms Projects

T2710 — Manufacturing Process Optimization of Azimuth and Inertial MEMS 96
T2716 — Development of Additive Manufacturing Processes for Corrosion Resistant Alloys 97
S2744 — Hatchable Cold Spray Technology for Naval Shipyards and Marine Corps Depots 98
S2745 — SPS-48E Radar Array-Slat Waveguide Refurbishment 99
T2783 — Optimizing X-ray Computed Tomography for Defect Detection 100

Manufacturing Process to Yield Higher Production Volumes



PERIOD OF PERFORMANCE:
July 2015 to October 2018

PLATFORM:
Other Sea Platforms

CENTER OF EXCELLENCE:
EMPF

POINT OF CONTACT:
Mr. Thomas Gill
(610) 362-1200 x215
tgill@aciusa.org

STAKEHOLDER:
PEO (Ships), NSWCDD

TOTAL INVESTMENT:
$981,000

T2710 — Manufacturing Process Optimization of Azimuth and Inertial MEMS

Objective

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

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

Payoff

This project will result in a production inertial sensor that meets Department of Defense requirements for a targeting system used by ground forces. This will allow the warfighter to utilize precision munitions, resulting in improved engagement efficiency and reduced collateral damage in all environmental conditions including GPS-denied. The sensors will result in a drastic reduction in SWaP-C and meet the U.S. Marine Corps' defined requirements for SWaP-C. The MEMS inertial sensor will be capable of full electronic calibration, without requiring rotational adjustment (i.e., no moving parts required). The technology is directly applicable to future low-cost, miniature missile guidance control systems, UAV robotic navigation, and stabilized weapon systems.

Implementation

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

Additive Manufacturing R&D in Support of the Navy's Fight against Corrosion

T2716 — Development of Additive Manufacturing Processes for Corrosion Resistant Alloys

Objective

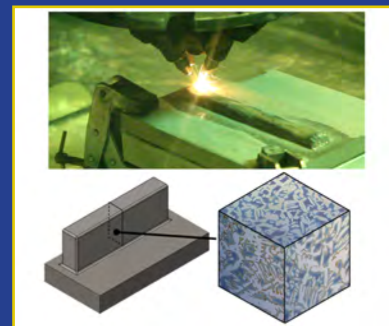
The Navy utilizes several corrosion-resistant alloys, such as Monel® K-400 and K-500 and Corrosion-Resistant Steels (CRES), in a range of turbomachinery and structural applications. Common product forms, such as bar, plate, or rod, provide limited geometries and frequently require significant levels of post-processing to produce the desired component geometries. These limited geometries and post-processing requirements result in long lead times and limited availability for critical components. However, additive manufacturing (AM) offers significant promise for the on-demand fabrication of parts of varying sizes and complexities. In AM technologies, components are built up in a layer-by-layer manner using either powder bed fusion or directed energy deposition processes. No concerted effort to analyze the impact of AM processes on the properties of corrosion-resistant materials of interest to the Navy has previously occurred. In this project, two categories of materials systems are being investigated. These materials systems include the Ni-Cu-based Monel® alloys and CRES alloys. Each of these systems has unique characteristics that can potentially make the AM processing of these alloys challenging.

Payoff

The Navy will significantly benefit from the fabrication of corrosion-resistant structural components using directed energy deposition AM processes. For applications common to the Naval Sea Systems Command (NAVSEA), component size and materials of interest fall outside the ranges typical for powder bed fusion processes. On the other hand, directed energy deposition processes can be adapted to a much wider range of material and product sizes, making it an attractive option for larger structural components. When combined with its ability to work with multiple materials, this AM process shows promise for addressing the size and diversity of components common to NAVSEA applications. This project will offer the opportunity to investigate the impact of AM on these classes of materials and provide a sound scientific foundation for developing a fundamental understanding of the governing process-structure-property relationships. This project will also serve as a test bed for the application of data analytics and data capture for important processing and property conditions.

Implementation

Each of the materials classes noted above has significant applicability to naval systems but also presents a range of challenges before they can be successfully processed using AM. Efforts will be directed at understanding the processing challenges and building a knowledge base for how a small range of processing conditions can impact the resulting structure and properties for important naval materials. As part of the process development work, a preliminary process and property database will be developed for these material systems. At the completion of the project, the technology basis developed for the AM fabrication of a range of different components using these materials systems will be applied to the near-term qualification and insertion of AM components into service. The Institute for Manufacturing and Sustainment Technologies team hopes to transition this knowledge to specific parts applications on ships within the FY19-FY20 timeframe.



PERIOD OF PERFORMANCE:
April 2016 to December 2018

PLATFORM:
Other Sea Platforms

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PEO (Ships), NSWCDD

TOTAL INVESTMENT:
$500,000

Innovative In-Situ Repair for Ships

PERIOD OF PERFORMANCE:
April 2017 to March 2019

PLATFORM:
Other Sea Platforms

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
NAVSEA 04X3, NAVSEA 04, USMC LOGCOM, Public Shipyards

TOTAL INVESTMENT:
$700,000

S2744 — Hatchable Cold Spray Technology for Naval Shipyards and Marine Corps Depots

Objective

This effort will develop and deliver a high-pressure hatchable cold spray system, commensurate support equipment, and operating procedures to include on-board ship, and will develop and validate shipboard repairs of specifically selected components.

The successful completion of the S2580 Cold Spray Proof of Procedure for Navy Shipboard Components project led to the identification of several additional components that could be repaired using cold spray technology. Repairing these components on board will result in significant time and cost savings by eliminating the need to remove them from the ship or submarine to facilitate repair. Additional components were identified that could be repaired pier side which will also result in significant cost savings. A new high-pressure cold spray system will be designed that can be transported throughout the ship to enable in-situ repair and to save extensive labor hours required to remove and replace ship systems. Supporting technology, such as dust collection, personal protective equipment, operator feedback, in-process quality assurance, and motion control, must also be developed and integrated with the cold spray system. This project leverages other ongoing cold spray efforts and will include applications for NAVSEA and the U.S. Marine Corps.

Payoff

Benefits that will result from this project include development of a man portable high-pressure Cold Spray system and supporting technology that can be used to perform shipboard, pier-side, and field repairs; approved repair processes for submarine and aircraft carrier components; repairs that return components to service that previously had to be scrapped; repair costs of less than 20 percent of the cost of a new component; reduced repair times (lead times taking as long as 24 months will now take one day to four weeks – depending on the component); and an improved process to identify additional candidate components for repair by shipyard or depot personnel. The estimated cost avoidance for the first five years of implementation is $8M for a return on investment of 13:1.

Implementation

The Hatchable Cold Spray systems will be implemented first at Intermediate Maintenance Facility Bangor and Puget Sound Naval Shipyard in mid-2019. Approved repairs are expected to be implemented in late 2019. The repair process will be governed by Uniform Industrial Process Instruction (UIPI). Information specific to the hatchable repairs will be developed as required by the UIPI. Other implementation sites include Navy shipyards and the Marine Depot at Albany, GA. The system will also be made available to NAVAIR facilities.

Extended Life Expectancy and Reduced Refurbishment Costs for SPS-48E Array-Slats

S2745 — SPS-48E Radar Array-Slat Waveguide Refurbishment

Objective

The Navy intends to replace all legacy SPS-48E radomes with new color-matched radomes that were developed under the Navy ManTech Electro-Optics Center S2487 SPS-48E Radome Manufacturing and Waveguide Refurbishment project. Under the current approved process, this will require a significant investment by the Navy because new waveguide stock will be needed to build array-slats for all SPS-48E antennas because there is no approved process to retrofit radomes. This Institute for Manufacturing and Sustainment Technologies project investigated whether the original array-slats that are currently in use can be refurbished and retrofitted. If successful, a significant cost savings will be generated.

Additionally, extensive corrosion and pitting plague SPS-48E array-slats near the end-flange causing reduced life expectancy. To help combat this corrosion and extend the life expectancy of the array-slats, an investigation of the corrosion type was undertaken to help mitigate existing corrosion and to prevent future corrosion from occurring. This work included changing the hardware from stainless to aluminum in order to eliminate galvanic corrosion from forming, a modified self-cleaning end-flange, and potential changes to the current refurbishment procedures and materials.

Payoff

This project offers a return on investment of 39:1 over five years and includes cost savings of $7.1M resulting from the re-use of array slats and a cost avoidance of $6M from the decrease in the periodicity of refurbishments from four to five years.

Implementation

Implementation is targeted for late FY18. Work will be performed and implemented at the Navy's current contract holder for SPS-48E refurbishment, Tri-Star Engineering (TSE) in Bedford, IN. Ultimately, the process will use TSE's current government-owned hardware so that implementation will be done at a lower cost. TSE currently handles all SPS-48E refurbishment and new array-slat builds, allowing them to easily implement the new process into the refurbishment process with minimal changes or additions to the current procedure. This project will allow TSE to meld both refurbishment and new array-slats build procedures into one process while removing the substantial cost of the bare waveguide material from future program budgets, thus reducing the overall budgetary needs of the Navy to keep the SPS-48E antenna fleet in service.

For implementation at TSE, PEO-IWS 2.0, NSWC-Crane, and the In-Service Engineering Agent will need to support the proposed changes / cost saving initiatives set forth by the project. This implementation will require four Class II, minor, Engineering Change Proposals, at a cost of $2K each. Three of the four changes are currently in the process of being implemented.

PERIOD OF PERFORMANCE:
April 2017 to September 2018

PLATFORM:
Other Sea Platforms

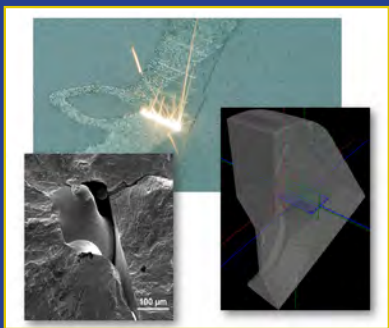
CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
NSWC-Crane, PEO-IWS2RE

TOTAL MANTECH INVESTMENT:
$319,000

Assuring that Additively Manufactured Metallic Components are Free of Detrimental Defects



PERIOD OF PERFORMANCE:
March 2018 to October 2019

PLATFORM:
Other Sea Platforms

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
NAVSEA

TOTAL INVESTMENT:
$500,000

T2783 – Optimizing X-ray Computed Tomography for Defect Detection

Objective

This Institute for Manufacturing and Sustainment Technologies (iMAST) project will investigate how the x-ray computed tomography (CT) analysis process and data reconstruction algorithms can be optimized for additive manufacturing (AM) metallic components. Different alloy systems that include titanium and stainless steel alloy systems will be investigated. The project will lay the initial foundation to better understand what critical defects need to be identified within high-value, high-risk AM components. In AM, components are built in a layer-by-layer manner using either powder bed fusion or directed energy deposition processes. AM offers significant promise to the Navy for on-demand fabrication of parts of varying sizes and complexities. The ability to "print on demand" will have significant impact on lead times and procurement costs for new and replacement components. The Navy is currently investigating the production of high-value, high-risk components by AM. However, AM is still an emerging technology, and the process can introduce several types of defects into the build such as lack-of-fusion porosity, gas porosity, and the entrapment of impurities. Non-destructive testing by x-ray CT has become the standard technique to qualify these high-value, high-risk components. CT can analyze and quantify internal structures (e.g., porosity) within components in three dimensions. The analysis of AM components by x-ray CT is complicated by many variables and these complications could lead to the failure to identify defects that would be detrimental to the component during service.

Payoff

In the coming years, the Navy is expected to significantly increase its AM footprint and the use of AM to produce both new and replacement components. This project will help validate a method of qualifying AM components prior to service and assure they perform as expected. This project will help meet the challenges of certifying AM components for structural applications. In addition, optimizing the x-ray CT process will help streamline the non-destructive testing of AM components allowing for rapid qualification of AM components for service.

Implementation

The alloy systems chosen for this investigation have significant applicability for naval systems. Efforts are directed toward better understanding the challenges of verifying that AM components are free of detrimental defects. In addition, efforts will be directed at better understanding critical defect size within a component. This effort includes establishing the groundwork to build a database of the impacts of defect size as a function of shape and the material systems investigated. At the completion of the project, the initial database of critical defect sizes along with the optimized x-ray CT techniques will be transferred to Navy to help qualify AM components. The iMAST team hopes to transition this knowledge and the testing techniques developed for the Navy within the FY20-FY21 timeframe for use on specific critical components through a follow-on project designed to mature the process for specific components.

Energetics Projects

A2575 — Energetics Production Utilizing Resonant Acoustic Mixing (RAM) 102
A2708 — Primary Explosive Manufacturing 103
A2774 — Additive Manufacturing for Propellants 104

RAM Technology Provides Safer and Cheaper Manufacturing of Energetic Materials

RAM-5 and existing production mixer

PERIOD OF PERFORMANCE:
July 2014 to December 2019

PLATFORM:
Energetics

CENTER OF EXCELLENCE:
EMTC

POINT OF CONTACT:
Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:
PEO U&W, PMA-242

TOTAL MANTECH INVESTMENT:
$1,310,000

A2575 — Energetics Production Utilizing Resonant Acoustic Mixing (RAM)

Objective

A Resonant Acoustic Mixer (RAM) uses a novel mixing technology developed for the U.S. Army under a Small Business Innovation Research project that was patented in 2007. There have been subsequent 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 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. RAM offers a number of benefits over vertical mixing.

As mentioned above, RAM provides a significant safety advantage over vertical mixing, and mixes much more quickly than conventional mixers. In addition, evaluation of the labor required for the proposed production process shows a cost reduction of about $100 per warhead, which has a current production cost of $1,500 each. At current production levels, this results in an annual savings of $1M to Mk 152 production, providing a 2.5-year return on investment. Additional savings would be achieved as the newly proven technology is used for other existing programs and new work. RAM also offers reduced footprint, new capabilities, and the potential to produce materials not easily processed using current mixing methods. Materials with higher viscosities and shorter pot lifes (solidification times) can be made.

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 first article testing.

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

CMTC
Composites Manufacturing Technology Center

Development of Manufacturing Capability for Primary Explosives

A2708 — Primary Explosives Manufacture

Objective

Many currently fielded military programs were developed 20-30 years ago. As such, these programs are continually faced with material obsolescence issues where current qualified suppliers have discontinued products or product lines. In most instances, the materials that are being discontinued are not available from alternate domestic suppliers, and it is necessary for alternate materials and/or sources to be identified to perform the same or similar function as the material being replaced.

Primary explosives are required as initiators or detonators for virtually every system involving energetic materials. They are typically quite sensitive to impact, friction, and temperature, etc. and used in small quantities to initiate explosives or propellants in everything from small arms to missiles and bombs. Many of the specialized primary explosives are used in cartridge actuated devices (CADs) to transmit a signal to a remote component, sequence events during an ejection, push a piston, eject a bomb, unlock a seat belt, actuate a fire extinguisher, cut and release, etc., and propellant actuated devices (PADs), small rocket motors used for propulsion (e.g., propelling an ejection seat out of an aircraft).

The project's objective is to develop the manufacturing capability for several critical primary explosives to ensure a continued Continental United States (CONUS) availability is being undertaken at NSWC Indian Head EOD Technology Division.

Payoff

Development of a manufacturing capability for critical primary explosives will ensure continued availability of these qualified materials. CONUS commercial sources for diazodinitrophenol (DDNP), lead mononitroresorcinate (LMNR), potassium dinitrobenzofuroxan (KDNBF), and barium styphnate either cannot meet the current annual requirement or no longer exist. Providing qualified sources of these materials will allow for continued sustainment of critical man-rated systems, such as those provided by the tri-service CAD / PAD Joint Program Office (JPO).

Implementation

The CAD / PAD JPO (PMA-201), as the single manager for CAD / PAD devices used in all DOD components, recognizes the negative impact of the inability and difficulty of procuring these materials. The CAD / PAD JPO endorses this ManTech project to advance the manufacturing methods for these primary explosives and will resource the evaluation and qualification of the new material in CAD / PAD applications.

DDNP, LMNR, KDNBF, and barium styphnate are primary explosives widely used in ordnance systems as components in explosive initiation trains. The primary applications are in cutters, squibs, and other CADs and PADs. DDNP is used in percussion caps and detonators; KDNBF is used in squib switches for missile systems; LMNR is used in Bellows motors and the MK 112 squib switch; and barium styphnate is used in semiconductor bridge ignitors for activation of thermal batteries.

PERIOD OF PERFORMANCE:
February 2016 to December 2019

PLATFORM:
Energetics

CENTER OF EXCELLENCE:
EMTC

POINT OF CONTACT:
Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:
PEO U&W PMA-201

TOTAL MANTECH INVESTMENT:
$1,489,000

Composites Manufacturing Technology Center

Enabling the Advanced Manufacture of Propellants

PERIOD OF PERFORMANCE:
January 2018 to December 2020

PLATFORM:
Energetics

CENTER OF EXCELLENCE:
EMTC

POINT OF CONTACT:
Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:
PEO U&W PMA-201

TOTAL MANTECH INVESTMENT:
$1,050,000

Composites Manufacturing Technology Center

A2774 — Additive Manufactuirng for Propellants

Objective

The objective of this effort is to enable the advanced manufacture of Navy / U.S. Marine Corps critical, solid propellant grains for use in cartridge actuated devices (CADs) and propulsion systems. Additive manufacturing (AM) is an advanced manufacturing technology that has the potential to produce lower cost propellant grains with little-to-no induced thermal stress / strain during cure. Under this effort, two types of AM technology will be explored for use in propellant manufacturing: material extrusion and vat photo-polymerization. Adaptation of these AM technologies for energetics will enable both composite and single- and double-base forms of propellants to be manufactured using advanced techniques.

Payoff

AM has become an attractive technology for low-volume production of specialized parts for as-needed applications. AM has flat cost per part vs. production volume curves, and would be far less sensitive to changes in product demand. While the year-to-year demand for the manufacture of new CADs containing HES-5808 is difficult to project, an advanced manufacturing technique like AM will provide increased sustainability and lower costs. Additionally, the implementation of an AM process will likely eliminate "cracking" commonly found during traditional grain manufacturing and would enable consistent CAD performance due to the potential for higher precision printed grains.

Implementation

The initial focus will be on the transitioning AM-produced HES-5808 grains into the M91 Impulse Cartridge utilized on the AV-8, F-15, F-16, and B-52 platforms. Upon completion of this project, the final formulation and technical information will be submitted to the CAD technical agent to determine energetic material qualification requirements and testing. Following this, Naval Ordnance Safety and Security Activity approval will be sought to use the AM-produced grain in the end-item application and validated by a design verification test (DVT). A critical design review (CDR) will analyze the results of the DVT prior to beginning the device qualification process. After the CDR, service release testing (SRT) will be conducted. SRT results will be reviewed to ensure all technical requirements are met, and if found acceptable, a Type III service release will be issued to allow manufacturing of the M91 with the AM grain. In order to achieve implementation of the AM-produced HES-5808 grain, the JPO technical agent (NSWC IHEODTD) will conduct the AM HES-5808 and M91 Impulse Cartridge qualification.

RepTech Projects

RT2682 — Low-Loss Launch Valve Plug Maintainability Improvement 106
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RTR2786 — Synchronized Cable Feeding System 112

New Process Increases Corrosion and Wear Resistance for Low Loss Launch Valves

PERIOD OF PERFORMANCE:
February 2016 to September 2018

PLATFORM:
RepTech

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PMS 378, NAVAIR

TOTAL MANTECH INVESTMENT:
$250,000

RT2682 — Low-Loss Launch Valve Plug Maintainability Improvement

Objective

The improved Low Loss Launch Valve (LLLV) is a steam catapult component deployed on CVN 68 through CVN 77. Each catapult has a LLLV which rotates to precisely meter the proper flow of steam to the power cylinders for aircraft launch. The LLLV plug is exposed to high temperature steam, condensate, graphite, and grease. A ceramic coating is applied to the area on the plug shaft just below the steam plug valve to increase wear and corrosion resistance. During refurbishment of the LLLV, the coating and a thin layer of base metal must be machined from the shaft to remove any material affected by the coating process. This process can remove enough material to reduce the diameter of the shaft to below the minimum acceptable diameter. Increasing the thickness of the bond coat can restore the LLLV shaft to the required diameter. Some LLLV shafts have shown evidence of corrosion. Therefore, an alternative sealant with higher temperature capabilities was examined to improve the corrosion performance.

The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) effort was to increase the thickness of the coating system while meeting the adhesion strength requirements and to improve the corrosion resistance. Initial efforts showed that adhesion strength decreases when bond coat thickness is increased. However, increasing the bond coat thickness by a factor of four resulted in adhesion strengths that were still above the required adhesion strength. Adhesion, microstructural analysis, and corrosion tests were performed. A high temperature sealant was produced and evaluated. A fixture was designed and tested to produce test samples during the coating process to determine the adhesion strength of the coating during production. Improvements to the plasma spray process were also investigated.

Payoff

The payoff includes a process that can be used to restore undersized LLLV plug shafts to the required diameter, increased corrosion and wear resistance, and an improved plasma spray process to apply the coatings. The cost of a new LLLV plug is $93K. Eight plugs are repaired annually. The cost savings for repairing the shafts over purchasing new plugs and for increasing the life of the LLLV plug shaft are $500K per year. An additional benefit includes extended time between repairs. The improved plasma spray process can be used on other Navy platforms as well.

Implementation

The repair processes will be implemented through Naval Air Warfare Center Aircraft Division - Lakehurst and the plasma spray vendor. Implementation will include test methods to validate the performance of the thicker plasma coatings. Final implementation is expected to occur in FY19.

Modular Staging and Scaffolding Will Reduce Planning and Unit Set-up Times

RTR2766 — Modular Staging and Scaffolding Inside Congested Buildings

Objective

This Rapid Response effort identified new designs and technologies for modular and quick-erect staging and scaffolding that can be utilized during the various stages of ship unit construction and planning, with particular focus on unit pre-outfitting and blasting and painting operations. General Dynamics Bath Iron Works (GDBIW) anticipates that modular, flexible staging could substantially reduce the planning and unit set-up times as it moves ship units through the manufacturing process.

Payoff

The project focused on five improvement areas: traveling scaffold which would support work platforms that move with the module as it migrates through its build cycle, modular / outfit support towers designed for unique applications and capabilities including built-in utilities, permanent or semi-permanent scaffolds that stay with specific facilities in the yard, purpose-built mockups which perform very specific functions within the build process, and other scaffolding ideas as they might emerge during the research phase. The resulting recommendations of this project were incorporated into BIW's procurement plan supporting its capital improvement efforts.

BIW estimated that annual savings of $776K per year are achievable when fully implemented. With a ManTech project cost of $100K and implementation costs of $1.5M, this yields a five-year return on investment of 1.4:1.

Implementation

GDBIW developed a specification to implement a permanent staging solution for the blast and paint area. The internally written specification was used to prepare a request for quote. GDBIW completed its vendor selection process and implementation will began fall 2018.

PERIOD OF PERFORMANCE:
December 2017 to April 2018

PLATFORM:
RepTech

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PMS 400D

TOTAL MANTECH INVESTMENT:
$100,000

Faster and More Accurate Measurement Device for Shipbuilding Repair

PERIOD OF PERFORMANCE:
November 2017 to September 2019

PLATFORM:
RepTech

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
NAVSEA

TOTAL MANTECH INVESTMENT:
$595,000

RT2767 — 3D Tape Measure

Objective

Point-to-point measuring is ubiquitous across all ship types and trades in ship construction and repair. The complex geometries of surface and subsurface ships complicate the measurement process. Outfitters and structural mechanics make multiple, multi-axis measurements to accurately locate attachment points and cuts or to size deck plates and canning plates, etc. This location and marking process is time-consuming.

Shipyard personnel have attempted to use arm-based (e.g., FaroArm®) coordinate measuring machines (CMMs) for shipbuilding and repair. CMMs are large, expensive, and fragile, and require computers and software. These characteristics make CMMs unsuitable for the shipbuilding environment. Shipbuilders and maintainers need a small, low-cost measurement device capable of providing accuracy equal to or better than conventional tape measures and paper patterning.

The objective of this project is to develop a small, inexpensive, self-contained (i.e., does not require a computer to take measurements), shock-resistant, and intrinsically safe device to locate – with a single measurement – points inside a six-foot diameter spherical space with extreme accuracy. This Institute for Manufacturing and Sustainment Technology project will accomplish this goal by integrating two commercial-off-the-shelf (COTS) 360° single-turn rotary encoders, one COTS multi-turn rotary encoder, and a stylus tool into a single device.

Payoff

The current estimate of measurement accuracy in shipbuilding is ± ⅛ inches for any single (i.e., x, y, or z) measurement. Assuming single-axis accuracy of ± ⅛ inches, total possible error for locating a point in space is currently approximately 0.22 inches. The total accuracy of the new device will increase accuracy within 0.11 inches.

For canning plate fabrication only, Puget Sound Naval Shipyard (PSNSY) & Intermediate Maintenance Facility estimates annual labor savings of 575 manhours per year. This equates to five-year savings of $977,500 for the public yards only (575 manhours * $85/manhour = $48.9K / shipyard / year; $195.5 K / year (canning plates, all public yards only).

Additionally, Huntington Ingalls Industries - Ingalls Shipbuilding provided the following potential use cases: profiling of castings; e.g., anchor bolsters and strut castings; levelling and squaring shell plates in the Shell Shop; checking contour points of complex shapes and topside layouts; improving layout accuracy of package unit foundations; verifying pipe details; laying out square reference control lines (Fab Shop) across multiple plates; and plumbing bulkheads.

Implementation

iMAST will fabricate and provide an industrial prototype to PSNSY in the third quarter of FY19. iMAST will also provide training and conduct demonstration / validation trials, while PSNSY will identify any additional issues and opportunities and recommend design improvements. iMAST will also identify potential manufacturers to commercialize the technology.

Innovative Repair for Legacy Missile Decoy Systems

RT2769 — Corrosion Repair of Missile Decoy Systems

Objective

The successful completion of this project will provide repair processes for Mk-36, 53, 59, and 234 Decoy Launching Systems; the components are fabricated from Al-6061 and suffer from corrosion damage during use. Furthermore, the components are expensive to repair and require long lead times to replace. Many of the repairs have to be performed outside the United States due to international agreement with allied nations. An efficient and economical repair process will greatly reduce operating costs, increase system availability, and reduce repair times.

The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) project is to develop and transition cold spray repair processes to the Department of the Navy (DoN), Naval Surface Warfare Center, Crane, and its support contractor to repair decoy launching systems.

Payoff

Cold spray technology is rapidly growing in Department of Defense (DoD) applications. The DoN has been proactively and successfully implementing this technology in innovative applications as a repair for components that could not previously be returned to service. Benefits that will result from this project include reduced repair time and cost, improved readiness, and a repair process that can be used on similar Al-6061 components. The estimated cost avoidance for the first five years of implementation is $4.6M for a return on investment of 21:1.

Implementation

The repair process being developed through this project will be implemented first through a Crane-selected cold spray vendor followed by the Norfolk Naval Shipyard / Mid-Atlantic Regional Maintenance Center when DoD cold spray systems become available. The repair process will be governed by Uniform Industrial Process Instruction (UIPI) 6320-901. Detailed repair specifications for the decoy launching systems will be developed as required by the UIPI. Implementation is expected in FY19.

PERIOD OF PERFORMANCE:
November 2017 to December 2018

PLATFORM:
RepTech

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
Naval Surface Warfare Center – Crane Division COM

TOTAL MANTECH INVESTMENT:
$156,000

Marine Corps Depot Uses Simulation to Improve Resource Planning and Reduce Costs

PERIOD OF PERFORMANCE:
December 2017 to December 2019

PLATFORM:
RepTech

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
Marine Corps Logistics Command (LOGCOM)

TOTAL MANTECH INVESTMENT:
$525,000

RT2770 — Marine Corps Depot Workflow Modeling

Objective

The U.S. Marine Corps depot in Albany, Georgia, performs maintenance on all types of Marine Corps vehicles and needs to accomplish this mission in a timely, cost-effective manner. On a regular basis, the depot has to contend with fluctuating workloads, increasing costs, resource constraints, unpredictable lead times for repair parts, and pressure to decrease costs and turnaround times for vehicles that come in for maintenance. Given these issues, the depot needs to be proficient at determining the resources needed to support its workload. "Resources" at a depot consist of three things: space, equipment, and personnel. The challenge of determining the optimal combination of resources to support a forecasted workload is complicated by the variation and uncertainty that is inherent in a depot maintenance environment. Variation and uncertainty in tasks and task durations make it difficult to determine what resources are needed, when they are needed, and for how long they are needed. Additional complications include variations in workload forecasts, changing workload priorities, uncertainty in the condition of incoming vehicles, high employee turnover, long lead times for spare parts, and uncertain funding availability.

The Institute for Manufacturing and Sustainment Technologies (iMAST) is developing a "Workflow Analysis & Resource Planning System," that can enable the depot to quickly estimate the resource levels needed to meet specified workload levels. The software tool will measure the depot's capacity, evaluate its material flow, identify its bottleneck operations, calculate resource utilizations, determine throughput, and assess overall efficiency. With this tool, depot management will be able to run different experiments to test the impact of changes in operations, workload, schedules, layouts, or routings, and make strategic decisions based on the outcomes that will improve operational performance and cost.

Payoff

The Workflow Analysis & Resource Planning System will identify and eliminate bottlenecks in depot operations. This will reduce excess material handling and waiting, and improve the utilization of resources. These improvements are expected to result in a 2-percent decrease in annual labor costs, or $1.4M per year. With a project cost of $525K and an estimated implementation cost of $100K, this yields a five-year return on investment of 10:1.

Implementation

The Workflow Analysis & Resource Planning System software application will be implemented at the Marine Corps depot in Albany, Georgia, in January 2020. The Marine Depot Maintenance Command (MDMC), supported by the Marine Corps Logistics Command (LOGCOM), will be responsible for installing and using the system. Implementation will include selecting, purchasing, and installing the simulation modeling software, obtaining the required cyber security approvals for the simulation modeling software, providing computers to host the software, attending software training, and supporting the system software. iMAST will provide training and user documentation to MDMC and LOGCOM personnel when the software is transitioned to the Marine Corps.

Track-Mounted UHP Blast System Reduces Time from Critical-Path CVN Shaft Coating Removal

RTR2772 — Dual-Track-Mounted UHP Waterjet GRP Shaft Coating Removal for CVN

Objective

CVN shafts are covered with a fiberglass or glass-reinforced plastic (GRP) coating. Shipyards must remove the GRP shaft coating to inspect and make repairs to the shaft. Shaft work is on the critical path for both ship maintenance availability and for undocking. Shipyards currently remove shafts from the vessel and transport them to another building for fiberglass removal. The shafts are then sent to another location for inspection and repairs. The intent of using a track-mounted ultra-high pressure (UHP) waterjet blasting process was to reduce transit, inspection, and GRP shaft coating removal time to shorten docking and possibly availability duration.

The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) Rapid Response project was to use the Applied Research Laboratory (ARL), Penn State-developed track-mounted UHP waterjet blast system to remove GRP coatings from CVN main propulsion shafts. Specifically, iMAST adapted ARL's dual-track-mounted UHP blasting system to a single-track system and modified the motion control system to control rotation of the Puget Sound Naval Shipyard (PSNSY) shaft roller, enabling single-pass removal of GRP shaft coatings. PSNSY designed and fabricated a track-mounted blast enclosure to contain blast debris, which was mounted atop the track-mounted system. This project has application to shaft coating removal operations for all ship classes.

Payoff

PSNSY estimated saving four days per shaft section (12 sections total). The project demonstrated a single-pass removal rate of 5 feet 8 inches per hour to remove GRP shaft coating from CVN shaft sections. Following completion of shaft coating removal operations, PSNSY estimated that using UHP waterjet and the system trimmed 35 days from this critical-path task.

Implementation

ARL is fabricating the prototype dual-track system for the Navy (one system per Navy shipyard). Upon completion of that project in September 2019, ARL will provide a mature design and technical data package to the Navy and each of the shipyards. The technical data package will include digital models, drawings, and associated parts lists, sufficient for a reasonably competent manufacturer to fabricate the system in production quantities.

PERIOD OF PERFORMANCE:
January 2018 to May 2018

PLATFORM:
RepTech

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
PSNSY, NAVSEA 04X, PMS 378

TOTAL MANTECH INVESTMENT:
$61,000

Motorized, Synchronous Cable Feeding System Expected to Reduce Cable Installation Cost and Schedule by 80 Percent

PERIOD OF PERFORMANCE:
May 2017 to June 2018

PLATFORM:
RepTech

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@arl.psu.edu

STAKEHOLDER:
SEA 04X

TOTAL MANTECH INVESTMENT:
$90,000

RTR2786 — Synchronized Cable Feeding System

Objective

The objective of this Institute for Manufacturing and Sustainment Technologies (iMAST) project was to build a cable feeding system capable of supporting the labor-intensive task of outfitting large diameter cables into submarines during ship's availability. Installers manually feed cable through manways and around turns by pulling cable into a space, looping it into coils, banding it, moving it, un-banding, pulling it into another space, re-looping it, etc. Manual cable installation is physically demanding (weighing in excess of 1 lb/ft) and generally requires two teams of five - six people per team that alternate between cable pulling and resting. Thus, manual cable pulling requires 10 -12 people per shift.

Puget Sound Naval Shipyard (PSNSY) engineers came up with an alternate approach to feed cable into the boat using multiple cable feed points and an array of low-friction roller-guides. Using multiple hand-cranked cable feeders, PSNSY demonstrated the ability to snake cable through a series of turns. Based upon the strength of this demonstration, the Technical Warrant Holder provided written approval for this approach, confirming that the PSNSY cable-feeding approach does not violate the intent of Note 1.10, USS SEAWOLF Class DWG 6404832 which states: Cables shall be installed taut in cableways without mechanical means such as rope or chain-falls.

After establishing a proof-of-concept, iMAST designed and fabricated a synchronized, three-motor system and integrated it into the PSNSY cable feeding mechanism.

Payoff

In June 2018, PSNSY used this three-drive-point system to snake approximately 180 feet of heavy electrical cable through multiple turns and vertical lifts using one man and taking 90 minutes. At full scale, PSNSY expects to use six total drive units to feed cable into position, then hand-feed cable into trays and pull it taut manually. PSNSY expects to reduce schedule duration from the current 162 days to less than 40 (a 75 percent reduction). PSNSY estimates 1,020 labor-days for the current manual cable-pulling process, and 227 labor-days using the synchronous cable feeding system, a labor reduction of 793 days or 77.7 percent.

Implementation

This approach to cable installation will work in both new acquisition and repair for all ship classes. The system is scalable to any number of drive units. Multiple synchronized cable-feeding units, coupled with customized guide-rollers, can be used to snake cable of almost any diameter and type through almost any path. iMAST envisions a plug-and-play system of cable feed units and roller guides on magnetic bases that can be mounted on any bulkhead, deck, or overhead. Customized, clamshell-style roller guides mounted on hangers or designed to snake cable into trays will enable installers to rapidly move cable into position, where it can be hand-fed into trays or hangers and pulled taut. Future system features will include a system dashboard and cable tension monitoring.

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